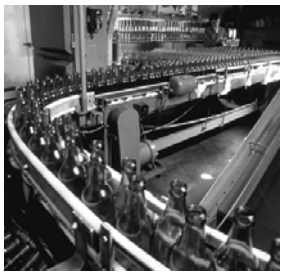
LISTEN.
THINK.
SOLVE.SM

PowerFlex® 700H Adjustable Frequency AC Drive / PowerFlex® 700S High Performance AC Drive



INSTALLATION MANUAL

Frames 9 - 14

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **http://www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.

Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

Manual Updates

The information below summarizes the changes to the *PowerFlex 700H and 700S Installation Instructions*, publication PFLEX-IN006, since the March 2006 release.

Change	Page
Updated the Normal Duty power ratings	Preface-1
Updated the Reference Materials List	Preface-1
Added information on installations using single-phase input power	1-2
Updated the Common Bus/Precharge information	1-9
Added a description for the use of output reactors on frame 14 drives	1-2
Updated the 700H I/O board options chart	2-2
Updated the “Auto/Manual Notes” section to include information on enabling manual mode to allow starts and jogs from the HIM in 2-wire mode	2-12
Added a note to the analog inputs on the 700S Phase II control	4-4
Added terminal wiring illustration for external brake resistor and external brake IGBT and resistor connections on frame 9 drives	6-6
Updated all Frame 10 dimension drawings to include cable routing information.	7-1 - 7-5
Added a dimension drawing for the frame 10 Motor Control Center (MCC), Enclosure Codes “B” and “K”	7-4
Updated the instructions for frame 10 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations	7-9
Updated the Power Terminal Block designations for frame 10 (removed brake option terminals)	7-14
Updated all Frame 11 dimension drawings to include cable routing information.	8-1 - 8-5
Added a dimension drawing for the frame 11 Motor Control Center (MCC), Enclosure Codes “B” and “K”	8-4
Updated the instructions for frame 11 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations	8-9
Updated all Frame 12 dimension drawings to include cable routing information.	9-1 - 9-5
Added a dimension drawing for the frame 12 Motor Control Center (MCC), Enclosure Codes “B” and “K”	9-4
Updated the instructions for frame 12 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations	9-9
Updated all Frame 13 dimension drawings to include cable routing information.	10-3 - 10-4
Updated the frame 13 dimensions for the NEMA/UL Type 12 - IP54 Enclosures	10-4
Updated the instructions for frame 13 Ungrounded, High Resistive Ground or Grounded B Phase Delta installations	10-5
Added Chapter 11 - Frame 14 Installation	11-1
Updated the Agency Certification information for drives with 700H control	A-1
Separated the drive ratings information from the drive protection devices - now in separate tables	A-5, A-13
Updated the drive rating, fusing and circuit breaker specifications	A-13
Added new Appendix B to consolidate the common lifting and mounting instructions	B-1
Added the Allen-Bradley 842HR rotary encoder to the list of compatible encoders	C-1
Updated wiring diagrams for the Hi-Resolution Encoder	C-2
Updated wiring diagrams for Resolvers	D-3
Updated wiring diagrams for the MDI board	E-3
Added Appendix E on ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors	F-1

The information below summarizes the changes to the *PowerFlex 700H and 700S Installation Instructions*, publication PFLEX-IN006, since the October, 2004 release.

Change	Page
Updated the drive ratings for PowerFlex 700H and 700S	Preface-1
Updated the information on installing unbalanced, ungrounded or resistive grounded distribution systems	1-1
Added information on DC input precharge control wiring	1-10
Updated the “Control Board Slot Designations” table for the new 20C-DG1 digital I/O option board	2-2
Added drive catalog numbers for 700H control I/O board options	2-2
Updated the “Analog Input, PTC 0-10V Input” wiring example	2-8
Added Chapter 4, “Control Wiring for PowerFlex 700S Drives with Series II Control”	4-1
Updated information on frame 9 operating temperatures	6-2
Updated frame 9 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems	6-4
Updated frame 10 minimum mounting clearances	7-1
Updated frame 10 operating temperatures	7-2
Added dimensions drawing for frame 10 NEMA/UL Type 12 - IP54 Enclosure	7-5
Updated frame 10 “Moving Control Frame” to show slotted holes in Control Frame	7-6
Updated frame 10 “Removing Protective Covers” to omit screws that were not present.	7-8
Updated frame 10 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems	7-9
Updated frame 11 minimum mounting clearances	8-1
Updated frame 11 operating temperatures	8-2
Added dimensions drawing for frame 11 NEMA/UL Type 12 - IP54 Enclosure	8-5
Updated frame 11 installation instructions for unbalanced, ungrounded or resistive grounded distribution systems	8-9
Added Chapter 9, “Frame 12 Installation”	9-1
Added Chapter 10, “Frame 13 Installation”	10-1
Updated the agency certifications	A-1
Updated the drive protection specifications	A-1
Updated the fusing and circuit breaker specifications	A-13, A-13
Added specifications and wiring diagram for using the Stahltronic linear encoder	E-3

Overview

Drive Description

Frame 9 - 14 PowerFlex® 700H and 700S AC drives are available in the following normal duty power ratings.

Drive	AC Input Range	HP Range	kW Range
700H	380-500V	200-2300	132-1600
	525-690V	150-2400	160-2000
700S	380-500V	200-1250	132-800
	525-690V	150-1600	160-1500

The 700H features a parameter set modeled after the PowerFlex 700 AC drive. Standard I/O includes either 24V or 115V digital I/O plus analog I/O NetLinx™ communication options, including DeviceNet™, ControlNet™ and EtherNet/IP networks.

The PowerFlex 700S offers optimized integration for the most demanding drive control and drive system applications. Available with embedded high-performance Logix engine (DriveLogix) to produce a highly functional, cost-effective drive and control solution.

Enclosure Options

The following enclosure types are available for PowerFlex 700H and 700S drives:

Drive	Enclosure Code	Enclosure Type	NEMA/UL Rating	Description
700H	A	Rittal TS 8 Modular	IP21, NEMA/UL Type 1	Single Door - Freestanding, Light Grey (RAL 7035)
	B	MCC Style	IP20, NEMA/UL Type 1	Single Door - Freestanding, Roll-in, Roll-out power structure
	H	Rittal TS 8 Modular	IP54, NEMA/UL Type 12(1)	Single Door - Freestanding, Filters in Door and Roof Vent
	J	No enclosure	IP00, NEMA/UL Type Open	With Conformal Coated Circuit Boards
	K	MCC Style	IP20, NEMA/UL Type 1	Single Door - Freestanding, Roll-in, Roll-out power structure, with Conformal Coated Circuit Boards
	M	Rittal TS 8 Modular	IP21, NEMA/UL Type 1	Single Door - Freestanding, Light Grey (RAL 7035), with Conformal Coated Circuit Boards
	N	No enclosure	IP00, NEMA/UL Type Open	–
	W	Rittal TS 8 Modular w/ Conformal Coat	IP54, NEMA/UL Type 12	Single Door - Freestanding, Filters in Door and Roof Vent

Drive	Enclosure Code	Enclosure Type	NEMA/UL Rating	Description
700S	A	Rittal TS 8 Modular	IP21, NEMA/UL Type 1	Single Door - Freestanding, Light Grey (RAL 7035)
	B	MCC Style	IP20, NEMA/UL Type 1	Single Door - Freestanding, Roll-in, Roll-out power structure
	N	No enclosure	IP00, NEMA/UL Type Open	–

(1) For replacement filters, refer to the PowerFlex Architecture Class Spare Parts & Options list available at: http://www.ab.com/support/abdrives/powerflex70/PF7ReleasedParts.pdf

Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to mount and wire Adjustable Frequency AC Drive devices.

What Is Not in this Manual

This manual is designed to provide drive mounting and wiring information. For start-up, programming and troubleshooting information, refer to the appropriate manual listed below.

Reference Materials

Allen-Bradley publications are available on the internet at *www.rockwellautomation.com/literature*.

The following manuals are recommended for general drive information:

Title	Publication
Industrial Automation Wiring and Grounding Guidelines	1770-4.1
Wiring and Grounding Guidelines for pulse Width Modulated AC Drives	DRIVES-IN001…
Preventive Maintenance of Industrial Control and Drive System Equipment	DRIVES-TD001…
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1
A Global Reference Guide for Reading Schematic Diagrams	100-2.10
Guarding Against Electrostatic Damage	8000-4.5.2

The following manuals are recommended for detailed PowerFlex 700H information:

Title	Publication
PowerFlex Reference Manual	PFLEX-RM001…
PowerFlex 700H Programming Manual	20C-PM001…

The following manuals are recommended for detailed PowerFlex 700S information:

Title	Publication
PowerFlex 700S with Phase I Control Reference Manual	PFLEX-RM002…
PowerFlex 700S with Phase II Control Reference Manual	PFLEX-RM003…
PowerFlex 700S with Phase I Control User Manual	20D-UM001…
PowerFlex 700S with Phase II Control User Manual	20D-UM006…

The following manuals are recommended for detailed installation and service information for PowerFlex 700H and 700S drives:

Title	Publication
Installation Instructions - PowerFlex 700H/S IP00 Open Pwr Structure - Frm 10-13	PFLEX-IN020...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 9)	PFLEX-TG001...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 10)	PFLEX-TG002...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 11)	PFLEX-TG003...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 12)	PFLEX-TG004...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 13)	PFLEX-TG005...
Hardware Service Manual - PowerFlex 700S and 700H Drives (Frame 14)	(not yet available)

For Allen-Bradley Drives Technical Support:

Title	Online at . . .
Allen-Bradley Drives Technical Support	**www.ab.com/support/abdrives**

Manual Conventions

- In this manual we refer to the PowerFlex 700H or 700S Adjustable Frequency AC Drive as:
  - drive
  - PowerFlex 700H
  - 700H
  - PowerFlex 700S
  - 700S
- To help differentiate parameter names and LCD display text from other text, the following conventions will be used:
  - Parameter Names will appear in [brackets].
    For example: [DC Bus Voltage].
  - Display Text will appear in “quotes.” For example: “Enabled.”
- The following words are used throughout the manual to describe an action:

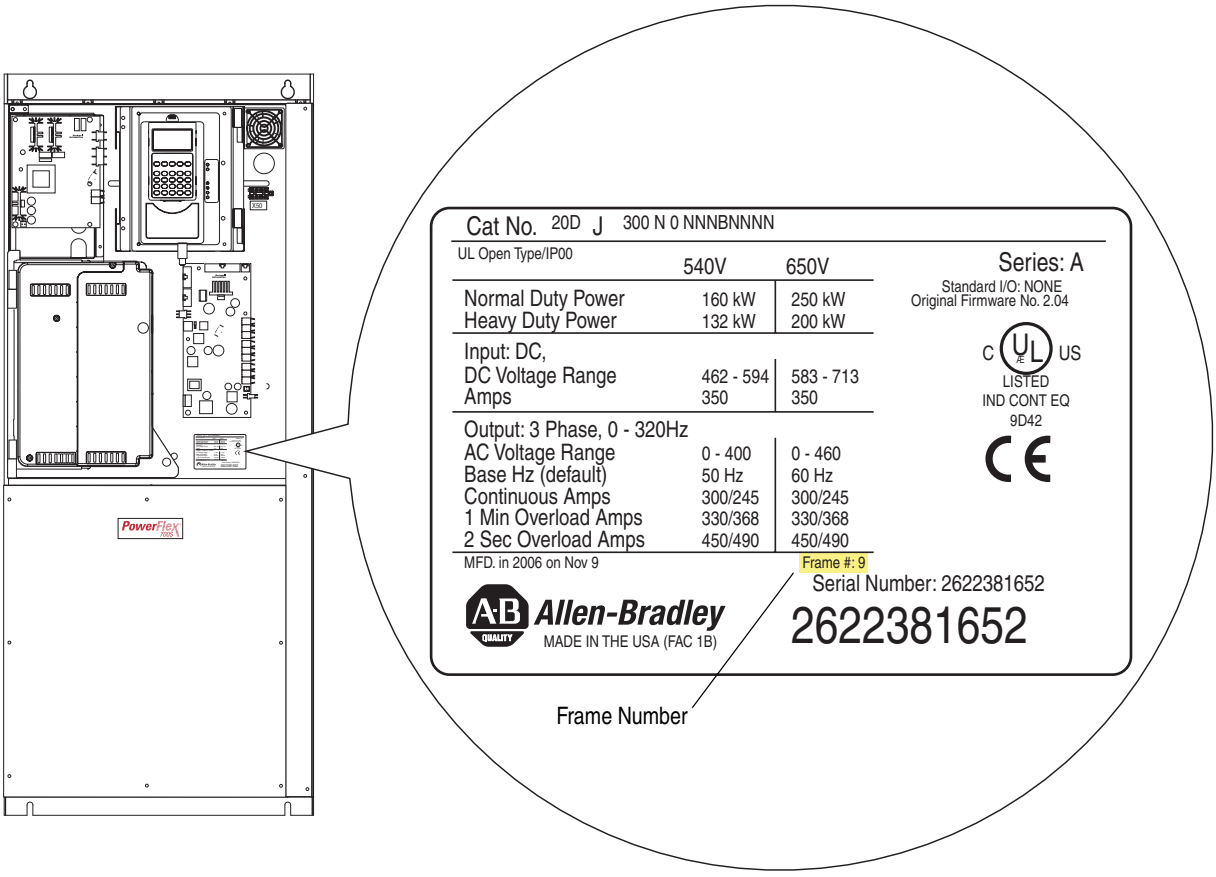
Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

Drive Frame Sizes

Similar PowerFlex 700H and 700S drive sizes are grouped into frame sizes to simplify spare parts ordering, dimensioning, etc. A cross reference of drive catalog numbers and their respective frame size is provided in Appendix A.

Identifying the Frame Size of the Drive

Determine the frame size of your drive by checking the data nameplate on the Control Frame. The frame number is printed just above the serial number.



General Precautions

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference A-B publication 8000-4.5.2, "Guarding Against Electrostatic Damage" or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged completely before servicing. Check the DC bus voltage at the Power Terminal Block by measuring between the +DC and -DC terminals, between the +DC terminal and the chassis, and between the -DC terminal and the chassis. The voltage must be zero for all three measurements.

ATTENTION: Risk of injury or equipment damage exists. DPI host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: The sheet metal cover and mounting screws on the ASIC Board located on the power structure are energized at (-) DC bus potential high voltage. Risk of electrical shock, injury, or death exists if someone comes in contact with the assembly.

ATTENTION: The “adjust freq” portion of the bus regulator function is extremely useful for preventing nuisance overvoltage faults resulting from aggressive decelerations, overhauling loads, and eccentric loads. It forces the output frequency to be greater than commanded frequency while the drive's bus voltage is increasing towards levels that would otherwise cause a fault. However, it can also cause either of the following two conditions to occur.

1. Fast positive changes in input voltage can cause uncommanded positive speed changes.

   A. *PowerFlex 700H* An “OverSpeed Limit” fault will occur if the speed reaches [Maximum Speed] + [Overspeed Limit]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes to less than 10%. Without taking such actions, if this operation is unacceptable, the “adjust freq” portion of the bus regulator function must be disabled (see parameters 161 and 162).

   B. *PowerFlex 700S* An “Abs Overspd Det” fault will occur if the speed reaches [Rev Speed Limit] - [Abs OverSpd Lim] or [Fwd Speed Limit] + [Abs OverSpd Lim]. If this condition is unacceptable, action should be taken to 1) limit supply voltages within the specification of the drive and, 2) limit fast positive input voltage changes. Without taking such actions, if this operation is unacceptable, disable the bus regulator by setting parameter 414 [Brake/ Bus Cnfg], bit 3 “Bus Reg En” to zero (0).

2. Actual deceleration times can be longer than commanded deceleration times.

   A. *PowerFlex 700H* A “Decel Inhibit” fault is generated if the drive stops decelerating altogether. If this condition is unacceptable, the “adjust freq” portion of the bus regulator must be disabled (see parameters 161 and 162). The “Decel Inhibit” fault can be disabled by setting parameter 238 [Fault Config 1] bit 6 “Decel Inhib” to zero (0).

   B. *PowerFlex 700S* A “Vref Decel Fail” fault is generated if the drive stops decelerating altogether. If this operation is unacceptable, disable the bus regulator by setting parameter 414 [Brake/Bus Cnfg], bit 3 “Bus Reg En” to zero (0). This fault cannot be disabled in the PowerFlex 700S.

Note: For both drives, installing a properly sized dynamic brake resistor or external dynamic brake will provide equal or better performance in most cases.

Important: These faults are not instantaneous. Test results show they can take 2-12 seconds to occur.

General Installation Information

AC Supply Source Considerations

Frame 9 - 14 PowerFlex 700H and 700S drives are suitable for use on a circuit capable of delivering up to a maximum of 200,000 rms symmetrical amperes, and a maximum of 690 volts.

ATTENTION: To guard against personal injury and/or equipment damage caused by improper fusing or circuit breaker selection, use only the recommended line fuses/circuit breakers specified in Appendix A.

If a system ground fault monitor (RCD) is to be used, only Type B (adjustable) devices should be used to avoid nuisance tripping.

Unbalanced, Ungrounded or Resistive Grounded Distribution Systems

If phase to ground voltage will exceed 125% of normal or the supply system is ungrounded, refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives,* publication DRIVES-IN001…, for more information.

ATTENTION: PowerFlex 700H and 700S drives contain protective MOVs and common mode capacitors that are referenced to ground. These devices must be disconnected if the drive is installed on a resistive grounded distribution system or an ungrounded distribution system.

If you are installing a...	refer to:
Frame 9 drive	Ungrounded, Unbalanced or High Resistive Ground Installations on page 6-4
Frame 10 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 7-9
Frame 11 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 8-9
Frame 12 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 9-9
Frame 13 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 10-5
Frame 14 drive	Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations on page 11-9

Single-Phase Input Power

The PowerFlex 700H and 700S drives are typically used with a three-phase input supply. The drives have been listed by UL to operate on single-phase input power with the requirement that the output current is derated by 80% of the three-phase ratings identified on pages A-5 to A-13.

Input Power Conditioning

All AC input drives include an internal line reactor.

Certain events on the power system supplying a drive can cause component damage or shortened product life. These conditions are:

- The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
- The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
- The power source has frequent interruptions.

If any or all of these conditions exist, it is recommended that the user install a minimum amount of impedance between the drive and the source. This impedance could come from the supply transformer itself, the cable between the transformer and drive or an additional transformer or reactor. The impedance can be calculated using the information supplied in the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…

Output Power Conditioning

Frame 14 drives can be ordered with or without output reactors (du/dt filters). The du/dt filter limits the rate of change of output voltage and the rate of change in the IGBT or output transistor switching event.

Refer to the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…, for minimum inductance on installations where du/dt filters are not installed.

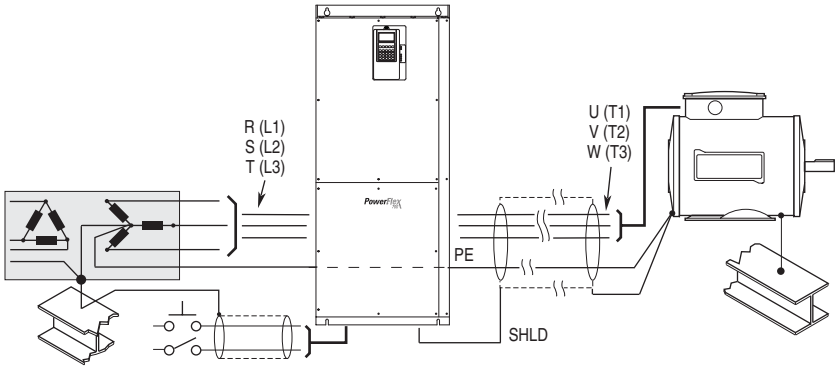
General Grounding Requirements

Safety Ground - PE

The drive Safety Ground - PE must be connected to system ground. Ground impedance must conform to the requirements of national and local industrial safety regulations and/or electrical codes. The integrity of all ground connections should be periodically checked.

For installations within a cabinet, a single safety ground point or ground bus bar connected directly to building steel should be used. All circuits including the AC input ground conductor should be grounded independently and directly to this point/bar.

Table 1.A Typical Grounding



Shield Termination - SHLD

The Shield terminal provides a grounding point for the motor cable shield. It must be connected to an earth ground by a separate continuous lead. The **motor cable** shield should be connected to this terminal on the drive (drive end) and the motor frame (motor end). A shield terminating cable gland may also be used.

When shielded cable is used for **control and signal wiring**, the shield should be grounded at the source end only, not at the drive end.

RFI Filter Grounding

Using an optional RFI filter may result in relatively high ground leakage currents. Therefore, the **filter must only be used in installations with grounded AC supply systems and be permanently installed and solidly grounded** (bonded) to the building power distribution ground. Ensure that the incoming supply neutral is solidly connected (bonded) to the same building power distribution ground. Grounding must not rely on flexible cables and should not include any form of plug or socket that would permit inadvertent disconnection. Some local codes may require redundant ground connections. The integrity of all connections should be periodically checked. Refer to the instructions supplied with the filter.

Fuses and Circuit Breakers

Frame 9 - 14 drives can be installed with either input fuses or an input circuit breaker. National and local industrial safety regulations and/or electrical codes may determine additional requirements for these installations. Refer to Appendix A for recommended fuses/circuit breakers.

ATTENTION: Frame 9 - 14 PowerFlex drives do not provide branch short circuit protection. Specifications for recommended fuses to provide protection against short circuits are provided in Appendix A.

Power Wiring

ATTENTION: National Codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

If you are installing...	refer to:
a Frame 9 drive	Power Wiring on page 6-5
a Frame 10 drive	Power Wiring on page 7-14
a Frame 11 drive	Power Wiring on page 8-13
a Frame 12 drive	Power Wiring on page 9-14
a Frame 13 drive	Power Wiring on page 10-12
a Frame 14 drive	Power Wiring on page 11-16

Cable Types Acceptable for 200-690 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75° C. Do not reduce wire gauge when using higher temperature wire.

Unshielded Cable

THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. **Do not use THHN or similarly coated wire in wet areas**. Any wire chosen must have a minimum insulation thickness of 15 mils and should not have large variations in insulation concentricity.

Shielded Cable

Shielded cable contains all of the general benefits of multi-conductor cable with the added benefit of a copper braided shield that can contain much of the noise generated by a typical AC drive. Strong consideration for shielded cable should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations or a high degree of communications/ networking are also good candidates for shielded cable.

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks. Refer to Chapter 5, "Reflected Wave" in *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001… for more information.

Consideration should be given to all of the general specifications dictated by the environment of the installation, including temperature, flexibility, moisture characteristics and chemical resistance. In addition, a braided shield should be included and be specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can greatly improve noise containment.

A good example of recommended cable is Belden® 295xx (xx determines gauge). This cable has four (4) XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Other types of shielded cable are available, but the selection of these types may limit the allowable cable length. Particularly, some of the newer cables twist 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known.

Armored Cable

Cable with continuous aluminum armor is often recommended in drive system applications or specific industries. It offers most of the advantages of standard shielded cable and also combines considerable mechanical strength and resistance to moisture. It can be installed in concealed and exposed manners and removes the requirement for conduit (EMT) in the installation. It can also be directly buried or embedded in concrete.

Because noise containment can be affected by incidental grounding of the armor to building steel when the cable is mounted, it is recommended the armored cable have an overall PVC jacket (see Chapter 2, "Wire Types," of

Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001…).

Interlocked armor is acceptable for shorter cable runs, but continuous welded armor is preferred.

Best performance is achieved with three spaced ground conductors, but acceptable performance below 200 HP is provided via a single ground conductor.

Table 1.B Recommended Shielded / Armored Cable

Location	Rating/Type	Description
Standard (Option 1)	600V, 90° C (194° F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90° C (194° F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

EMC Compliance

Refer to EMC Instructions for details.

Cable Trays and Conduit

If cable trays or large conduits are to be used, refer to guidelines presented in publication DRIVES-IN001… , *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*.

ATTENTION: To avoid a possible shock hazard caused by induced voltages, unused wires in the conduit must be grounded at both ends. For the same reason, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled. This will help minimize the possible shock hazard from “cross coupled” motor leads.

EMC Instructions

CE Conformity

Conformity with the Low Voltage (LV) Directive and Electromagnetic Compatibility (EMC) Directive has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. PowerFlex Drives comply with the EN standards listed below when installed according to this manual.

CE Declarations of Conformity are available online at:
http://www.ab.com/certification/ce/docs.

Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations.

EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods.

General Notes

- The motor cable should be kept as short as possible in order to avoid electromagnetic emission as well as capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- PowerFlex drives may cause radio frequency interference if used in a residential or domestic environment. The user is required to take measures to prevent interference, in addition to the essential requirements for CE compliance listed below, if necessary.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors can influence total machine/installation compliance.
- PowerFlex drives can generate conducted low frequency disturbances (harmonic emissions) on the AC supply system.

Essential Requirements for CE Compliance

Conditions 1-6 listed below **must be** satisfied for PowerFlex drives to meet the requirements of **EN61800-3**.

1. Standard PowerFlex 700H or 700S CE compatible Drive. For Frames 10 and up, the drive must also be installed in a suitable Rittal TS 8 (or equivalent) enclosure.
2. Review important precautions/attention statements throughout this manual before installing the drive.
3. Grounding as described on page 1-3.
4. Output power, control (I/O) and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.
5. All shielded cables should terminate with the proper shielded connector.
6. Conditions in Table 1.C.

Table 1.C PowerFlex EN61800-3 EMC Compatibility

Frame	**Second Environment** *Restrict Motor Cable to 30 m (98 ft.)* *Any Drive and Option*
9	✔
10	✔
11	✔
12	✔
13	✔
14	✔

Using Input/Output Contactors

Input Contactor Precautions

ATTENTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage will occur.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

Output Contactor Precaution

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as "Enable." This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

Common Bus/Precharge

The following information must be read and understood:

- DC input drives do not have an internal precharge. Therefore:
  - Precharge capability must be provided in the system to guard against possible damage, and
  - disconnect switches must not be used between the input of the drive and a common DC bus without the use of an external precharge device.

Important: Precharge circuitry is external to the drive.

DC Input Precharge Control Wiring

If you are installing a DC input drive with a precharge interlock you must make the following connections on the X50 terminal block from the precharge circuit. Refer to Figure 1.1 on page 1-11 for additional information.

Table 1.D X50 Terminal Block Connections

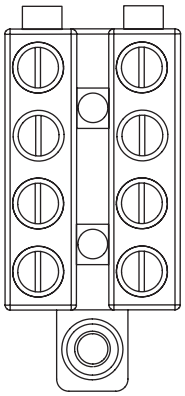
X50 Terminal Block	Frame	Terminal	Description
	9	1	Charge Relay Contact
		2	Charge Relay Contact
		5	Precharge Complete Signal (+24V DC)
		6	Precharge Complete Signal (Common)
	10, 11 & 13	3	Charge Relay Contact
		4	Charge Relay Contact
		1	Precharge Complete Signal (+24V DC)
		2	Precharge Complete Signal (Common)
	12 & 14	Power Module 1	
		3	Charge Relay Contact (Jumper to Power Module 2 Terminal 4)
		4	Charge Relay Contact
		1	Precharge Complete Signal (+24V DC)
		2	Precharge Complete Signal (Common)
		Power Module 2	
		3	Charge Relay Contact
		4	Charge Relay Contact (Jumper to Power Module 1 Terminal 21)
		1	Precharge Complete Signal (+24V DC)
		2	Precharge Complete Signal (Common)

Table 1.E X50 Terminal Block Specifications

Wire Size Range[1]		Torque
Maximum	**Minimum**	**Recommended**
6.0 mm^2 (10 AWG)	1.0 mm^2 (18 AWG)	0.8 N•m (7.0 lb•in)

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

Table 1.F External Relay Contact Ratings

Load	Resistance load (cos ϕ = 1)
Rated load	8 A at 250 VAC: 5 A at 30 VDC
Rated carry current	8 A
Max. switching voltage	250 VAC; 30 VDC, (400 VAC)[1]
Max. switching current	AC 8 A; DC 5 A
Max. switching power	2,000 VA; 150 W
Failure rate (reference value)	5 VDC 10 mA (for gold plating 0.35 µ min.)

(1) P level: $\lambda 60 = 0.1 \times 10^{-6}$ operations

Figure 1.1 Frame 9 Sample Precharge Wiring Diagram

External precharge circuitry is shown as dashed lines.

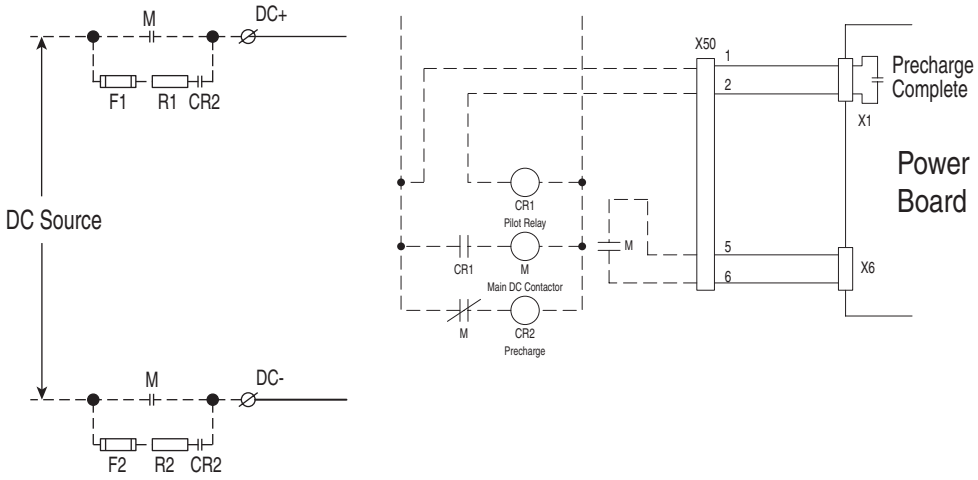


Figure 1.2 Frames 10, 11 and 13 Sample Precharge Wiring Diagram

External precharge circuitry is shown as dashed lines.

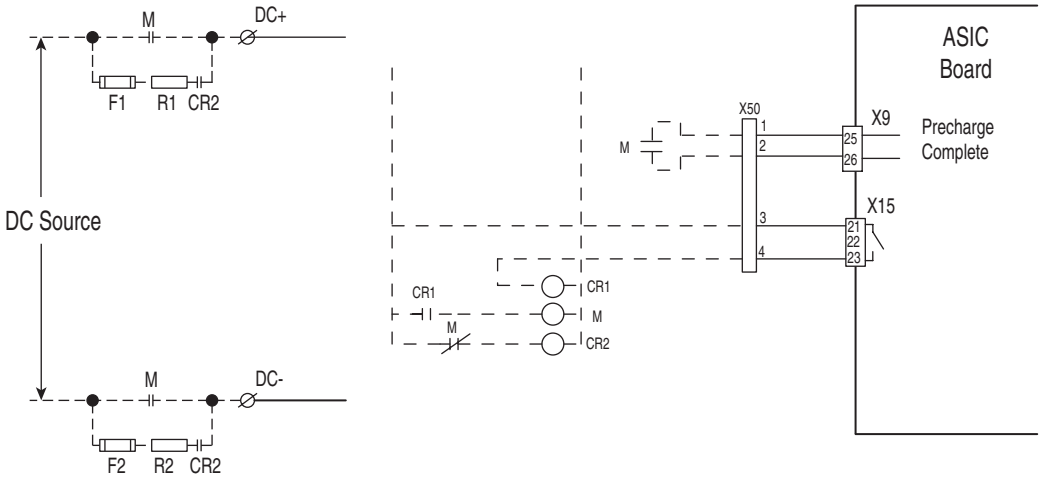


Figure 1.3 Frames 12 and 14 Sample Precharge Wiring Diagram

External precharge circuitry is shown as dashed lines.

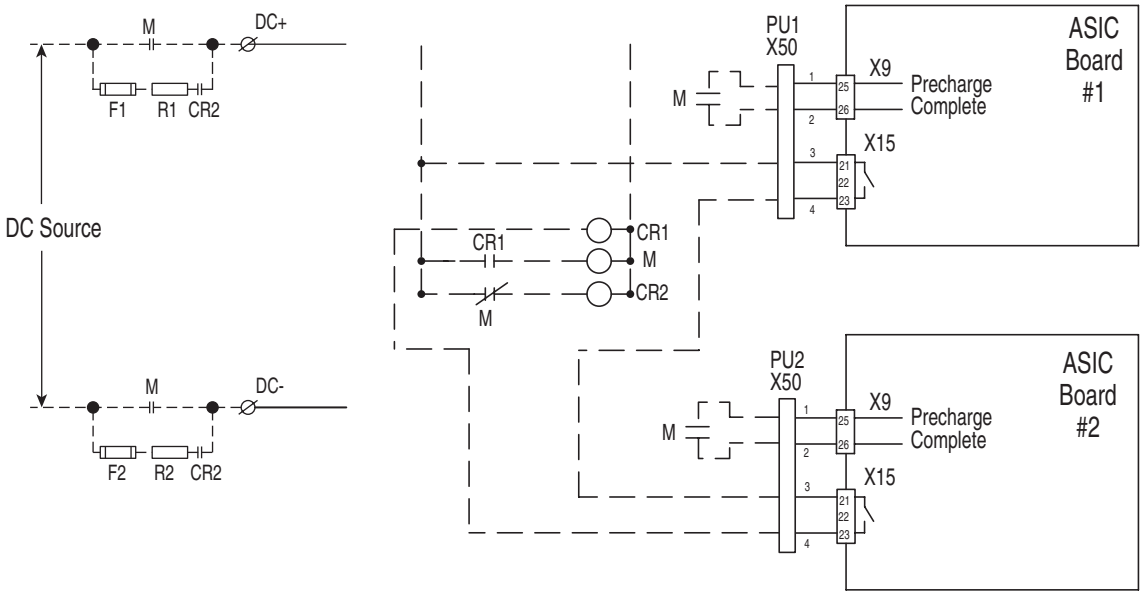
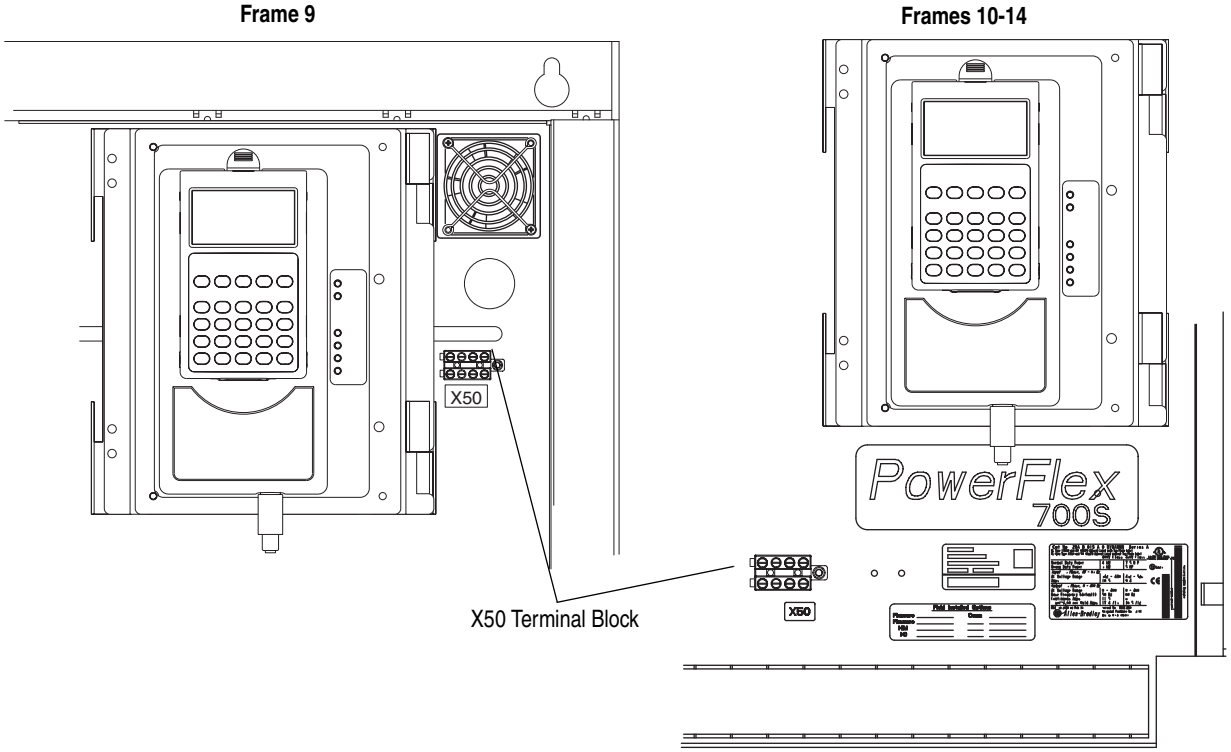


Figure 1.4 Frame 9 - X50 Terminal Block Location



PowerFlex® 700H Control Wiring

Important points to remember about I/O wiring:

- Always use copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).

Important: Control (I/O) terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Inputs must be configured with software and jumpers (see page 2-6). In addition, configuring an analog input for 0-20mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Signal and Control Wire Types

Table 2.A Recommended Signal Wire

Signal Type	Wire Type(s)	Description	Minimum Insulation Rating
Analog I/O	Belden 8760/9460 (or equiv.)	0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (1).	300V, 75-90° C (167-194° F)
	Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 cond., shielded for remote pot only.	
EMC Compliance	Refer to EMC Instructions on page 1-7 for details.		

(1) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

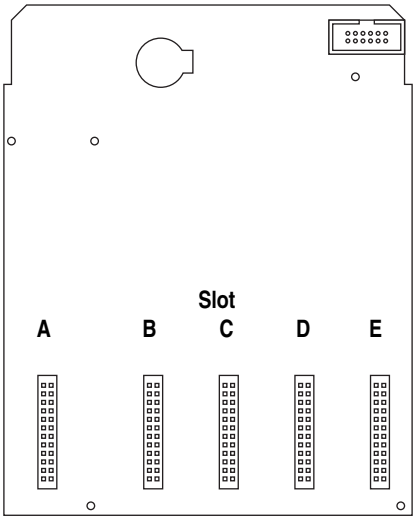
Table 2.B Recommended Control Wire for Digital I/O

Type	Wire Type(s)	Description	Minimum Insulation Rating
Unshielded	Per US NEC or applicable national or local code	–	300V, 60° C (140° F)
Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

700H Control Circuit Board Designations

The PowerFlex 700H control circuit board allows for a variety of I/O boards to be installed depending upon your application. Each option I/O circuit board is described below.

Figure 2.1 PowerFlex 700H Control Circuit Board



Important: The boards identified in the table below can only be installed in the designated slot. Boards and slots are not interchangeable.

Table 2.C Control Board Slot Designations

Slot	Used for Circuit Board . . .	Part No.
A	24V DC Digital Input with Analog I/O	20C-DA1-A
	115V AC Digital Input with Analog I/O	20C-DA1-B
B	24/115V Digital Output	20C-DO1
	24V DC Digital Gate Disable option(1)	20C-DG1
C	(Not Used)	–
D	(Not Used)	–
E	DPI Option Board	20C-DPI1

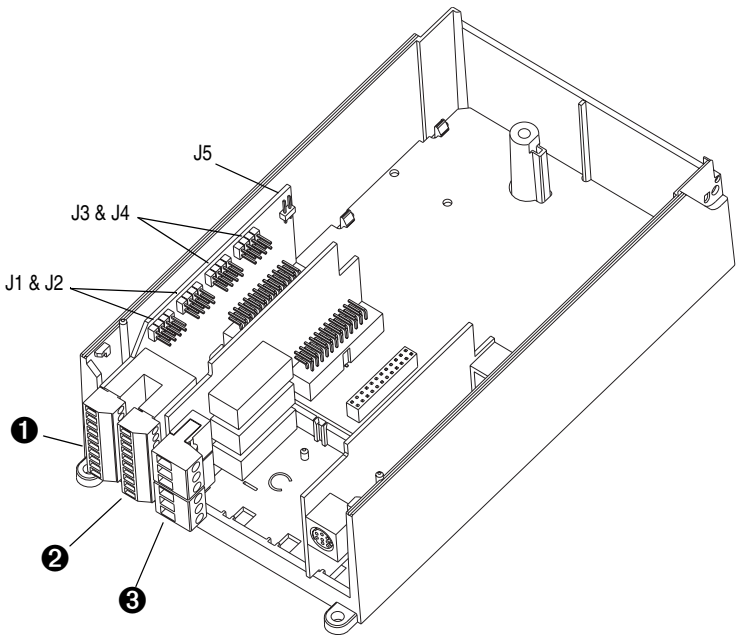
(1) Refer to Appendix F, Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information on installing and configuring the Gate Disable option board.

Drive Catalog Numbers for 700H Control I/O Board Options

The following codes are designated in position 15 of the drive catalog string to indicate the desired combination of 700H I/O option boards supplied with the drive:

Code	Board in Slot A	Board in Slot B	Board in Slot E
A	20C-DA1-A	20C-DO1	20C-DPI1
B	20C-DA1-B	20C-DO1	20C-DPI1
G	20C-DA1-A	20C-DG1	20C-DPI1
N	none	none	20C-DPI1

Figure 2.2 PowerFlex 700H I/O Terminal Blocks & Jumpers



I/O Terminal Blocks and Jumpers

I/O Terminal Blocks

Table 2.D I/O Terminal Block Specifications

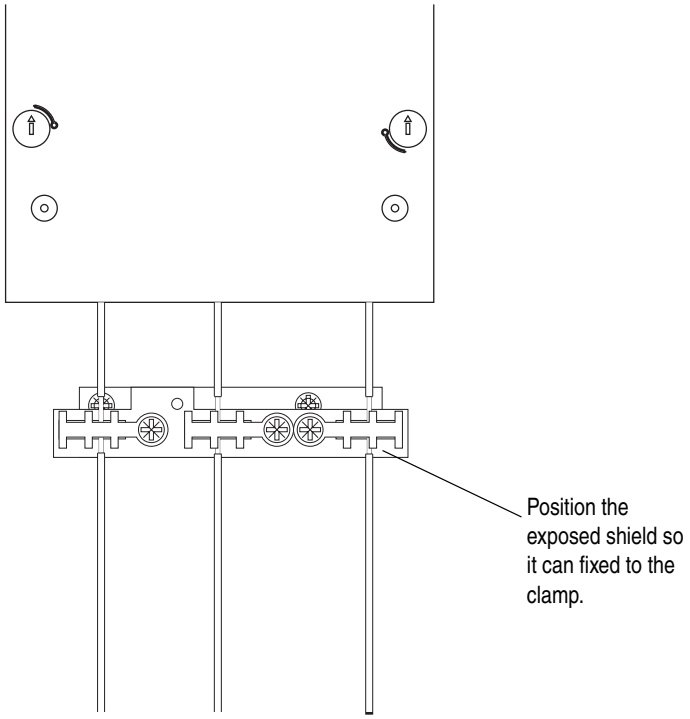
No.	Name	Description	Wire Size Range[2]		Torque	
			Maximum	Minimum	Maximum	Recommended
1	Analog I/O	Analog I/O Signals	2.5 mm^2 (14 AWG)	0.5 mm^2 (22 AWG)	0.2 N-m 1.8 lb.-in.	0.2 N-m 1.8 lb.-in.
2	Digital Inputs	Digital Input Signals	2.5 mm^2 (14 AWG)	0.5 mm^2 (22 AWG)	0.2 N-m 1.8 lb.-in.	0.2 N-m 1.8 lb.-in.
3	Digital Outputs[1]	Digital Out Relays	2.5 mm^2 (14 AWG)	0.5 mm^2 (22 AWG)	0.5 N-m 4.5 lb.-in.	0.5 N-m 4.5 lb.-in.

(1) Refer to Appendix F, Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information on installing and configuring the Gate Disable option board.

(2) Maximum/minimum that the terminal block will accept - these are not recommendations.

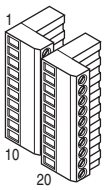
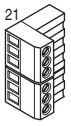
I/O Cable Grounding

When installing shielded multi-conductor for analog and digital I/O, strip the cable at such a distance from the terminal plug so you can fix the shield to the cable clamp for grounding.



Note: This clamp is not designed for strain relief.

Figure 2.3 I/O Terminal Designations

	No.	Signal	Factory Default	Description	Related Parameter(s)
	1	Analog Input 1 (–)(1)	(2)	Isolated(3), bipolar, differential, 9 bit & sign, 88k ohm input impedance. A jumper (page 2-6) selects: 0-10V, ±10V, 4-20mA. Default: 0-10V (Ri =200k), 4-20mA (Ri=100 ohm).	320 - 327
	2	Analog Input 1 (+)(1)			
	3	Analog Input 2 (–)(1)			
	4	Analog Input 2 (+)(1)			
	5	–10V Pot Reference	–	2k ohm minimum, 10 mA maximum load, 1% accuracy.	
	6	Pot Common (GND)		For (+) and (–) 10V pot references.	
	7	+10V Pot Reference	–	2k ohm minimum, 10mA maximum load, 1% accuracy.	
	8	Analog Output 1 (+)	(2)	Bipolar (current out is not bipolar), 9 bit & sign, 2k ohm minimum load. A jumper (see page 2-6) selects: 0-10V, ±10V, 4-20mA.	340 - 347
	9	Analog Output Common			
	10	Analog Output 2 (+)			
	11	Digital Input 1	Stop - CF	115V ac, 50/60 Hz - Opto isolated Low State: less than 30V ac High State: greater than 40V ac 24V dc - Opto isolated (250V) Low State: less than 5V dc High State: greater than 20V dc 11.2 mA DC Enable: Digital Input 6 is jumper selectable for HW Enable. On-Time: < 16.7ms, Off-Time < 1ms	361 - 366
	12	Digital Input 2	Start		
	13	Digital Input 3	Auto/Man		
	14	Digital Input 4	Speed Sel 1		
	15	Digital Input 5	Speed Sel 2		
	16	Digital Input 6/Hardware Enable, see pg. 2-6	Speed Sel 3		
	17 18	Digital Input Common		Allows source or sink operation. Terminals 17/18 & 19 can also be used to provide backup power to DPI and control devices.	
	19	+24V DC (4)	–	Drive supplied logic input power.	
	20	24V Common (4)	–	Common for internal power supply.	
	21	Digital Output 1 – N.C. (5)	Fault	Max. Resistive Load: 240V ac/30V dc – 1200VA, 150W Max. Current: 5A, Min. Load: 10mA Max. Inductive Load: 240V ac/30V dc – 840VA, 105W Max. Current: 3.5A, Min. Load: 10mA	380 - 391
	22	Digital Output 1 Common			
	23	Digital Output 1 – N.O. (5)	NOT Fault		
	24	Digital Output 2 – N.C. (5)	NOT Run		
	25	Digital Output 2/3 Com.			
	26	Digital Output 3 – N.O. (5)	Run		

(1) **Important:** Input must be configured with a jumper. Drive damage may occur if jumper is not installed properly. Refer to page 2-6.

(2) These inputs/outputs are dependant on a number of parameters (see “Related Parameters” column in table).

(3) Differential Isolation - External source must be maintained at less than 160V with respect to PE. Input provides high common mode immunity.

(4) 150mA maximum load. Not present on 115V versions. Can be used to provide control power from an external 24V source when main power is not applied. Refer to page 2-6.

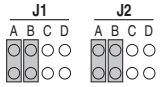
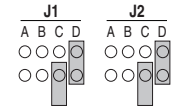
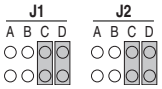
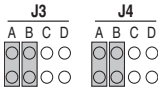
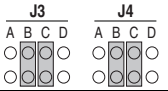
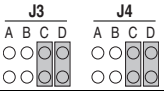
(5) Contacts in un-powered state. Any relay programmed as Fault or Alarm will energize (pick up) when power is applied to drive and de-energize (drop out) when a fault or alarm exists. Relays selected for other functions will energize only when that condition exists and will de-energize when condition is removed.

Analog I/O Configuration

Important: Analog I/O must be configured through programming, as well as the jumpers shown below. Refer to publication 20C-PM001…, *PowerFlex 700H Adjustable Frequency AC Drive - Programming Manual.*

Refer to Figure 2.2 on page 2-3 for the location of the jumpers indicated in the table below.

Table 2.E I/O Configuration

Signal	Jumper	Setting		
Analog Inputs	J1 (Analog In 1) J2 (Analog In 2)	0-20 mA	0-10V	±10V
				
Analog Outputs	J3 (Analog Out 1) J4 (Analog Out 2)	0-20 mA	0-10V	±10V
				

Hardware Enable Circuitry

By default, the user can program a digital input as an Enable input. The status of this input is *interpreted by drive software*. If the application requires the drive to be disabled *without* software interpretation, a "dedicated" hardware enable configuration can be utilized. This is done by removing jumper J5 and wiring the enable input to "Digital In 6" (see below). Verify that parameter 366 [Digital In6 Sel] is set to "1 - Enable".

Table 2.F Hardware Enable Configuration

Signal	Jumper	Setting	
Hardware Enable	J5	Hardware Enable	Input Programmable (No Hardware Enable)
			

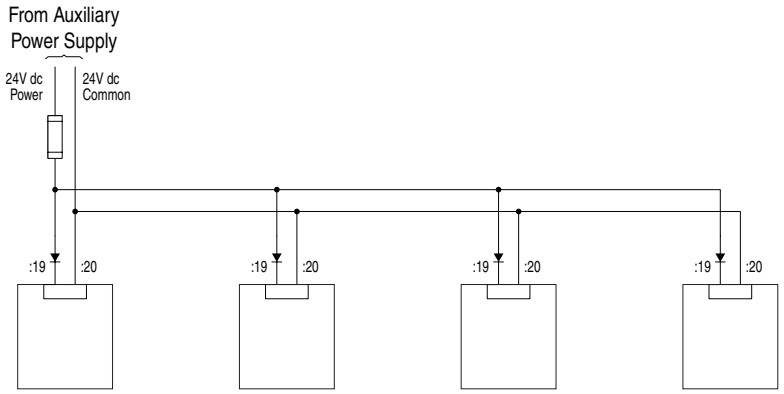
Auxiliary Power Supply

You may use an auxiliary power supply to keep the 700H Control Unit energized, when input power is de-energized. This provides back-up power for the Control Unit and is sufficient for setting parameters. Connect 24V dc power to pin 19 and 24V dc common to pin 20 of the 24V dc version of the I/O card.

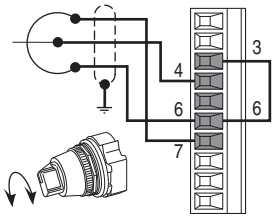
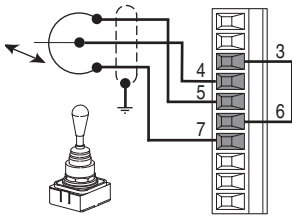
Auxiliary Power Supply Specifications

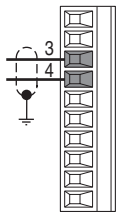
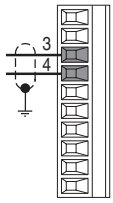
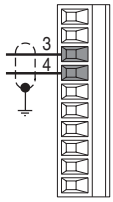
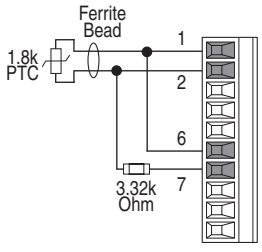
Voltage	Current (Min)	Current (Max)
24V dc ± 15%	150 mA	250 mA

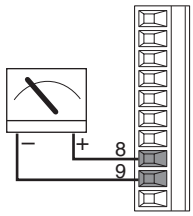
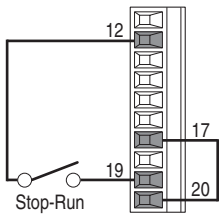
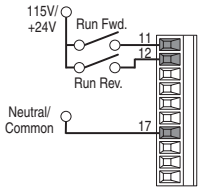
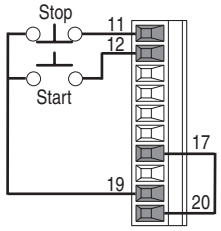
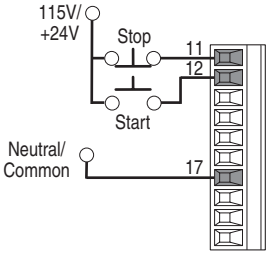
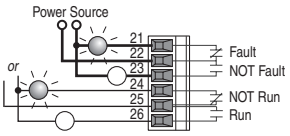
If 24V terminals of several drives are connected in parallel, we recommend using a diode circuit to block current flow in the opposite direction. Reverse current flow could damage the Control Board.

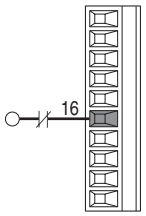


I/O Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Potentiometer Unipolar Speed Reference(1) 10k Ohm Pot. Recommended (2k Ohm Minimum)		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Joystick Bipolar Speed Reference(1) ±10V Input		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Set parameter 190 [Direction Mode] = 1 “Bipolar” • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]

Input/Output	Connection Example	Required Parameter Changes
Analog Input Bipolar Speed Reference ±10V Input		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Set parameter 190 [Direction Mode] = 1 “Bipolar” • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Voltage Input Unipolar Speed Reference 0 to +10V Input		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Configure Input with parameter 320 [Anlg In Config] • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Current Input Unipolar Speed Reference 4-20 mA Input		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Configure Input for Current: Parameter 320 [Anlg In Config] and add jumper at appropriate terminals • Adjust Scaling: Parameters 91 [Speed Ref A Hi] / 92 [Speed Ref A Lo] and 325 [Analog In 2 Hi] / 326 [Analog In 2 Lo] • View Results: Parameter 002 [Commanded Speed]
Analog Input, PTC 0-10V Input PTC OT set > 5V PTC OT cleared < 5V PTC Short < 0.2V		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Configure Analog Input for PTC function: Set parameter 259 [Alarm Config 1] bit 14 “PTC Config” = Enabled • Configure Analog Input for Fault when input goes below 0.2V: Set parameter 324 [Analog In 1 Loss] = 1 “Fault” • Enable Fault: Set parameter 238 [Fault Config 1] bit 7 “Motor Therm” = Enabled • Enable Alarm: Set parameter 259 [Alarm Config 1], bit 11 “Motor Therm” = Enabled

Input/Output	Connection Example	Required Parameter Changes
Analog Output ±10V, 4-20 mA Bipolar +10V Unipolar *(shown)*		• Set I/O configuration (refer to Analog I/O Configuration on page 2-6). • Configure with Parameter 340 [Anlg Out Config] • Select Source Value: Parameter 384 [Digital Out1 Sel] • Adjust Scaling: Parameters 343 [Analog Out1 Hi] / 344 [Analog Out1 Lo]
2-Wire Control Non-Reversing(2) 24V dc internal supply		• Disable Digital Input:#1: Parameter 361 [Digital In1 Sel] = 0 "Not Used" • Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 7 "Run" • Set Direction Mode: Parameter 190 [Direction Mode] = 0 "Unipolar"
2-Wire Control Reversing(2) External supply (I/O Board dependent)		• Set Digital Input:#1: Parameter 361 [Digital In1 Sel] = 8 "Run Forward" • Set Digital Input #2: Parameter 362 [Digital In2 Sel] = 9 "Run Reverse"
3-Wire Control Internal supply		• No Changes Required
3-Wire Control External supply (I/O Board dependent). Requires 3-wire functions only ([Digital In1 Sel]). Using 2-wire selections will cause a type 2 alarm.		• No Changes Required
Digital Output Relays shown in powered state with drive faulted. See page 2-5. 2 relays at terminals 24-26.		• Select Source to Activate: Parameters 380 [Digital Out1 Sel] / 384 [Digital Out2 Sel]

Input/Output	Connection Example	Required Parameter Changes
Enable Input		• Configure with parameter 366 [Digital In6 Sel] For dedicated hardware Enable: Remove Jumper J5 (see page 2-6)

(1) Refer to the Attention statement on page 2-1 for important bipolar wiring information.

(2) **Important:** Programming inputs for 2 wire control deactivates all HIM Start buttons unless parameter 192 [Save HIM Ref], bit 1 "Manual Mode" = "1." This will allow the HIM to control Start and Jog.

Reference Control

"Auto" Speed Sources

The drive speed command can be obtained from a number of different sources. The source is determined by drive programming and the condition of the Speed Select digital inputs, Auto/Manual digital inputs or reference select bits of a command word.

The default source for a command reference (all speed select inputs open) is the selection programmed in parameter 90 [Speed Ref A Sel]. If any of the speed select inputs are closed, the drive will use other parameters as the speed command source.

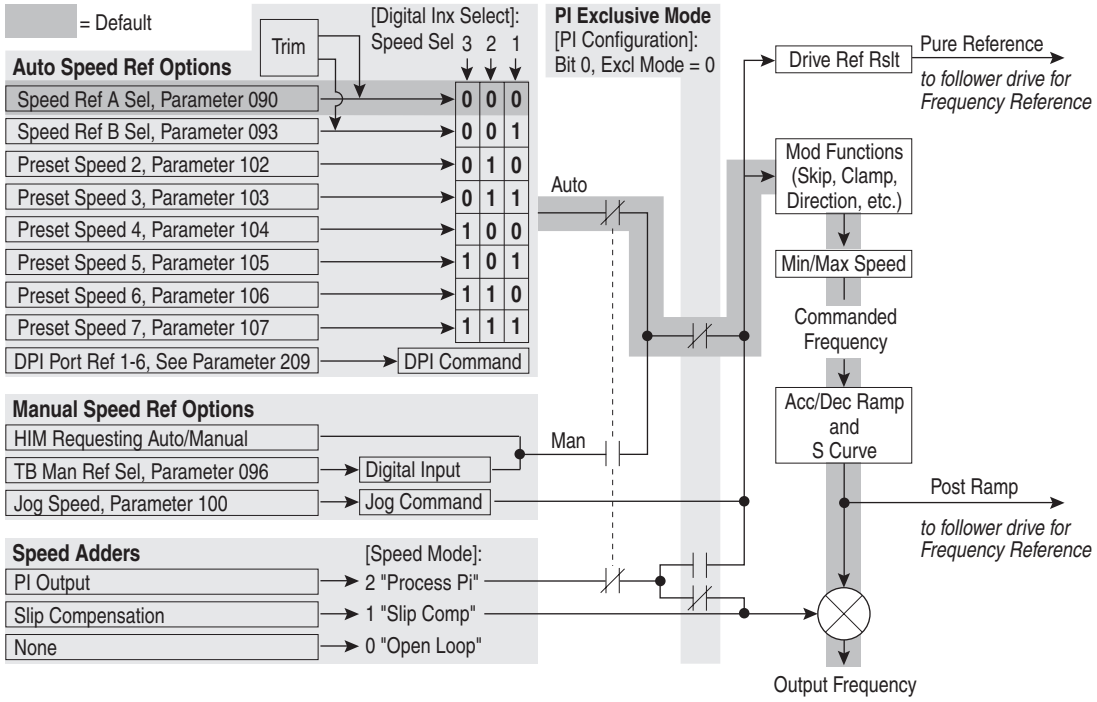
"Manual" Speed Sources

The manual source for speed command to the drive is either the HIM requesting manual control or the control terminal block (analog input) if a digital input is programmed to "Auto/Manual."

Changing Speed Sources

The selection of the active Speed Reference can be made through digital inputs, DPI command, jog button or Auto/Manual HIM operation.

Figure 2.4 Speed Reference Selection Chart(1)



Auto/Manual Examples

PLC = Auto, HIM = Manual

A process is run by a PLC when in Auto mode and requires manual control from the HIM during set-up. The Auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source.

Attain Manual Control

- Press ALT then Auto/Man on the HIM.
  When the HIM attains manual control, the drive speed command comes from the HIM speed control keys or analog potentiometer.

Release to Auto Control

- Press ALT then Auto/Man on the HIM again.
  When the HIM releases manual control, the drive speed command returns to the PLC.

(1) To access Preset Speed 1, set parameter 090 or 093 to "Preset Speed 1."

PLC = Auto, Terminal Block = Manual

A process is run by a PLC when in Auto mode and requires manual control from an analog potentiometer wired to the drive terminal block. The auto speed reference is issued by the PLC through a communications module installed in the drive. Since the internal communications is designated as Port 5, [Speed Ref A Sel] is set to "DPI Port 5" with the drive running from the Auto source. Since the Manual speed reference is issued by an analog input ("Analog In 1 or 2"), parameter 96 [TB Man Ref Sel] is set to the same input. To switch between Auto and Manual, parameter 364 [Digital In4 Sel] is set to "Auto/ Manual".

Attain Manual Control

- Close the digital input.
  With the input closed, the speed command comes from the pot.

Release to Auto Control

- Open the digital input.
  With the input open, the speed command returns to the PLC.

Auto/Manual Notes

1. Manual control is exclusive. If a HIM or Terminal Block takes manual control, no other device can take manual control until the controlling device releases manual control.
2. If a HIM has manual control and power is removed from the drive, the drive will return to Auto mode when power is reapplied.
3. Parameter 192 [Save HIM Ref] can enable manual mode to allow starts and jogs from the HIM in 2-wire mode.

Control Wiring for PowerFlex 700S Drives with Phase I Control

I/O Wiring

Important points to remember about I/O wiring:

- Always use tinned copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
- 4100CCF3 Flex I/O cable for use with DriveLogix is limited to a 3 ft. maximum length.

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Table 3.A Recommended Control Wire

Type		Wire Type(s)	Description	Insulation Rating
Digital I/O	Un-shielded	Per US NEC or applicable national or local code	–	300V, 60° C (140° F), Minimum
	Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

Type		Wire Type(s)	Description	Insulation Rating
Standard Analog I/O	Belden 8760/9460 (or equiv.)		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain [5].	300V, 75-90 °C (167-194 °F)
Remote Pot	Belden 8770 (or equiv.)		0.750 mm^2 (18 AWG), 3 cond., shielded	
Encoder/ Pulse I/O Less 30.5 m (100 ft.)	Combined:	Belden 9730 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded.	
Encoder/ Pulse I/O 30.5 m (100 ft.) to 152.4 m (500 ft.)	Signal:	Belden 9730/9728 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 [2]	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9892 [3]	0.330 mm^2 or 0.500 mm^2 [3]	
Encoder/ Pulse I/O 152.4 m (500 ft.) to 259.1 m (850 ft.)	Signal:	Belden 9730/9728 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 [2]	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9773/9774 (or equivalent) [4]	0.750 mm^2 (18 AWG), individually shielded pair.	
EMC Compliance	Refer to EMC Instructions on page 1-7 for details.			

(1) Belden 9730 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9728 (or equivalent).

(2) Belden 8790 is 1 shielded pair.

(3) Belden 9892 is 3 individually shielded pairs (3 channel), 0.33 mm^2 (22 AWG) plus 1 shielded pair 0.5 mm^2 (20 AWG) for power.

(4) Belden 9773 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9774 (or equivalent).

(5) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

Wiring the Main Control Board I/O Terminals

Terminal blocks TB1 and TB2 contain connection points for all inputs, outputs and standard encoder connections. Both terminal blocks reside on the Main Control Board.

Remove the terminal block plug from the socket, and make the connections.

Reinstall the plug, when wiring is complete. The terminal blocks have keys, which make it difficult to insert a terminal plug into the wrong socket.

Table 3.B Main Control Board I/O Terminal Locations

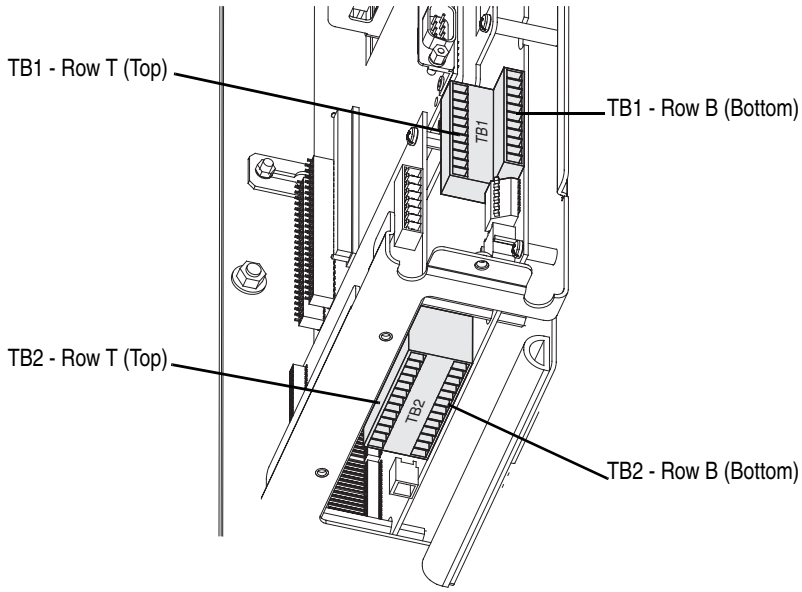
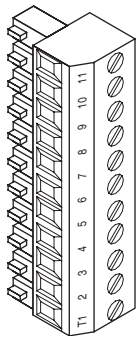


Table 3.C Main Control Board I/O Terminal Block Specifications

		Wires Size Range[1]		Torque	
Name	**Description**	Maximum	Minimum	Maximum	Recommended
I/O & Encoder Blocks	Signal & Encoder power connections	1.5 mm^2 (16 AWG)	0.14 mm^2 (28 AWG)	0.25 N-m (2.2 lb.-in.)	0.22 N-m (1.9 lb.-in.)

(1) Maximum/minimum sizes the terminal block will accepts - these are not recommendations.

Table 3.D TB1 - Row T (Top) Terminals



Terminal	Signal	Description	Related Parameter
T11	Power Supply 24V dc Return (-)	Power and common for precharge and enable inputs.(1) Inputs may sink or source.(2) Rating: 100 mA maximum.	
T10	Power Supply 24V dc (+)		
T9	Logic Common		
T8	Digital Input 1 Default = Precharge	For common DC bus drives. Must be high, for drive to complete the precharge cycle. Load: 20 mA at 24V dc.	824, 826, 827, 828, 829, 838
T7	Enable Input	Must be high for drive to run. Load: 20 mA at 24V dc.	824, 825
T6	Digital Output 1	24V dc open collector (sinking logic) output. Rating: 25 mA maximum.	824, 843, 844
T5	Digital Output 2	24V dc open collector (sinking logic) output. Rating: 25 mA maximum.	824, 845, 846
T4	Digital Output Return	Return for Digital outputs 1 and 2.	
T3	Thermistor Input	Used only in FOC2 mode with approved motor for temperature adaptation. Refer to Appendix A, “Supplemental Information”, in publication 20D-UM001..., *User Manual - PowerFlex 700S High Performance AC Drive, Phase I Control*, for approved motors.	485
T2	Thermistor Input Return		
T1	Thermistor Shield		

(1) The drive’s 24V dc power supply supports only on-board digital inputs. Do not use it to power circuits outside of the drive.

(2) Refer to wiring examples of sinking and sourcing outputs.

Figure 3.1 TB1 - Row T (Top) Wiring Examples

The following definitions are used throughout this section:

Source

A. Apply positive voltage through the device to the input or output.

B. Connect the input or output common (return) directly to the power supply common.

Sinking

A. Apply the positive voltage directly to the input or output common (return).

B. Connect the input or output to the power supply common through the device

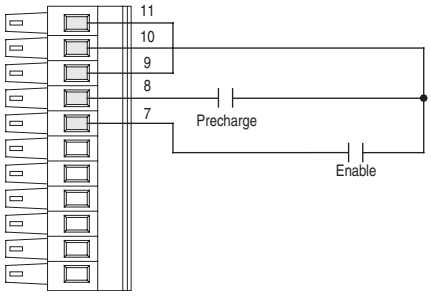
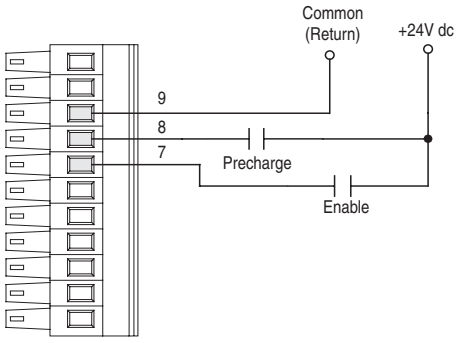
Input/Output	Connection Example	Required Parameter Changes
Digital Inputs used for enable and precharge control. *Note:* **24V dc Supply** - supports only on-board digital inputs. Do not use for circuits outside the drive.	Sourcing Precharge and Enable Inputs - using internal power supply  Sourcing Precharge and Enable Inputs - using external power  	**Enable** - In a sourcing configuration, this circuit must connect to a 24V dc power for the drive to run. **Precharge** Precharge control is used in common bus configurations and is not required for AC fed drives. If precharge control is not required, reprogram Par 838 [DigIn1 Sel] to a value of zero or replace the contact shown with a jumper from terminal 8 to terminal 10. If precharge is needed, in sourcing configuration, this circuit must connect to 24V dc power for the drive to complete the precharge cycle.

Figure 3.1 TB1 - Row T (Top) Wiring Examples

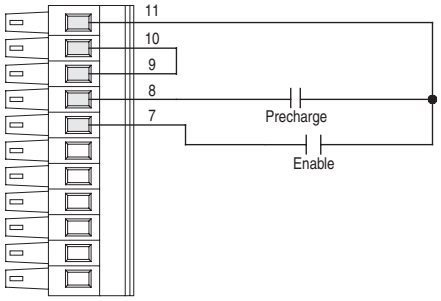
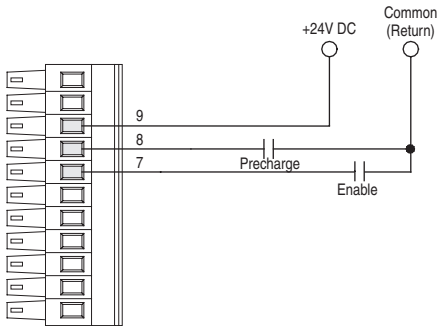
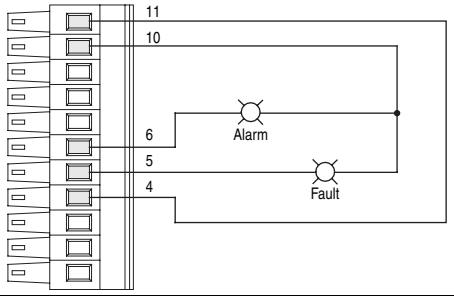
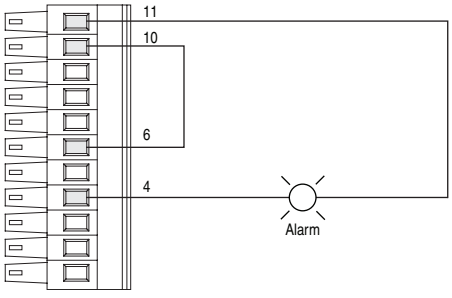
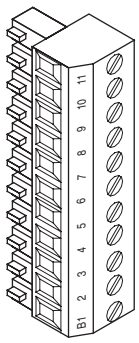
Input/Output	Connection Example	Required Parameter Changes
	Sinking Precharge and Enable Inputs - using internal power supply 	**Enable** - In a sinking configuration, this circuit must connect to a 24V dc return for the drive to run. **Precharge** Precharge control is used in common bus configurations and is not required for AC fed drives. If precharge control is not required, reprogram Par 838 [DigIn1 Sel] to a value of zero or replace the contact shown with a jumper from terminal 8 to terminal 11. If precharge is needed, in sinking configuration, this circuit must connect to a 24V dc return for the drive to complete the precharge cycle.
	Sinking Precharge and Enable Inputs - using external power supply 	
Digital Outputs - 24V dc outputs 25 mA maximum per output.	Digital Output 1 Indicating Alarm and Digital Output 2 Indicating Fault - in sourcing configuration 	**Example: Using Digital Outputs 1 and 2 to Annunciate Alarms and Faults** • Link Parameter 155 [Logic Status], the source, to Parameter 843 [DigOut 1 Data], the sink • Set Parameter 844 [DigOut 1 Bit] to a value of 8, so that parameter 155 [Logic Status], bit 8 “Alarm” will control the output • Link Parameter 155 [Logic Status], the source, to Parameter 845 [DigOut 2 Data], the sink • Set Parameter 846 [DigOut 2 Bit] to a value of 7, so that Parameter 155 [Logic Status], bit 7 “Faulted” will control the output
Digital Output - 24V dc output 25 mA maximum per output. If one output is configured in sinking, the other output is not available.	Digital Output 1 Indicating Alarm Fault - in sinking configuration 	**Example: Using Digital Output 1 to Annunciate Alarms** • Link Parameter 155 [Logic Status], the source, to Parameter 843 [DigOut 1 Data], the sink • Set Parameter 844 [DigOut 1 Bit] to a value of 8, so that Parameter 155 [Logic Status], bit 8 “Alarm” will control the output

Table 3.E TB1 - Row B (Bottom) Terminals



Terminal	Signal	Description	Related Parameter
B11	Analog Input 1 (-)	+/-10.0V dc or +/-1.0V dc bipolar, differential input. (1) 13 bit + sign, 20k ohm input impedance.	800, 802, 803, 804, 805
B10	Analog Input 1 (+)		
B9	Analog Input Shield	Optional connection point for analog input shield. (2)	
B8	Analog Input 2 (-)	+/-10.0V dc or +/-1.0V dc bipolar, differential input. (1) 13 bit + sign, 20k ohm input impedance.	806, 808, 809, 810, 811
B7	Analog Input 2 (+)		
B6	Analog Output 1 (+)	+/-10.0V dc bipolar, differential output, 11 bit + sign, 2k ohm minimum load.	812, 814, 815, 817, 818
B5	Analog Output 1 Return (-)		
B4	Analog Output Shield	Optional connection point for analog output shield. (2)	
B3	Analog Output 2 (+)	+/-10.0V dc bipolar, differential output, 11 bit + sign, 2k ohm minimum load.	813, 819, 820, 822, 823,
B2	Analog Output 2 Return (-)		
B1	Analog Output Shield	Optional connection point for analog shields.	

(1) Refer to Analog Input Settings on page 3-17 for necessary dip switch settings.

(2) Analog shields should connect to common at the signal source, if possible. Shields for signals from ungrounded devices, such as analog tachometers, should connect to an analog shield terminal point at the drive.

Figure 3.2 TB1 - Row B (Bottom) Wiring Examples

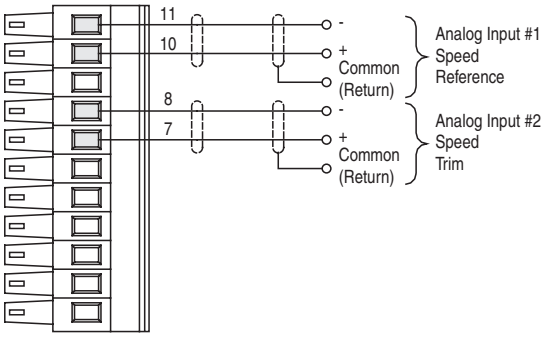
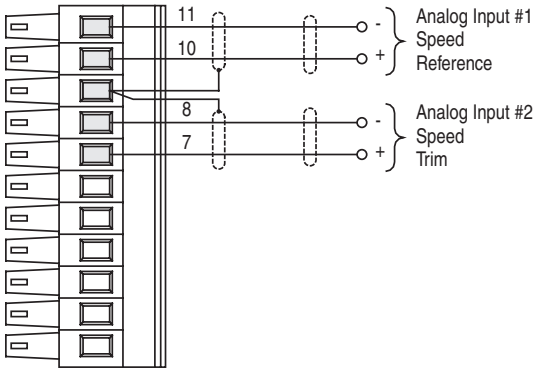
Input/Output	Connection Example	Required Parameter Changes
Analog Inputs +/-10V dc or +/-1.0V dc (DIP switch selectable) Terminate shields at the analog source if analog common is available Used for Speed Reference and Speed Trim	Analog Inputs for Speed Reference and Speed Trim - shield terminated at the source  Analog Inputs for Speed Reference and Speed Trim - shield terminated at the drive  	**Example: Using Analog Input 1 as 0-10V speed reference** • Adjust Parameter 803 [Anlg In1 Offset] so that the minimum analog signal creates the minimum speed reference (if the minimum input is 0V dc and the minimum speed reference is zero, enter a value of zero) • Adjust Parameter 802 [Anlg In1 Scale] so that the maximum analog signal creates the maximum speed reference (if the maximum input is 10V dc and the maximum speed reference is motor base speed, enter a value of 0.1) • Send the data to the Speed Reference parameter Par 10 [Speed Ref 1] (the destination) linked to Par 800 [Anlg In1 Data] (the source) • Select 1 - “Spd Ref 1” as the active speed ref in Par 16 [Speed Ref Sel] • In Par 153 [Control Options] set bit 0 “Bipolar SRef” = 1 **Example: Using Analog Input 2 as -10 to +10V speed trim @ 10%:** • Adjust Parameter 809 [Anlg In2 Offset] so that the minimum analog signal creates the minimum speed trim (if the minimum input is 0V dc and the minimum trim is zero, enter a value of zero) • Adjust Parameter 808 [Anlg In2 Scale] so that the maximum analog signal creates the maximum speed trim (if the maximum input is 10V dc and the maximum speed trim is 10%, enter a value of 0.01) • Send the data to the Par 12 [Speed Ref 2] (the destination) linked to Par 806 [Anlg In2 Data] (the source) • Use Par 10 [Spd Ref 1] as the active speed reference and Par 12 [Spd Ref 2] as the speed trim. Set Par 16 [Speed Ref Sel] = 3 - “Spd Ref 3”

Figure 3.2 TB1 - Row B (Bottom) Wiring Examples

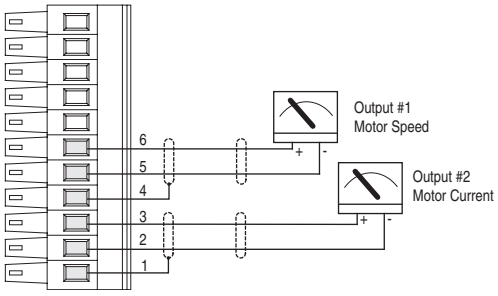
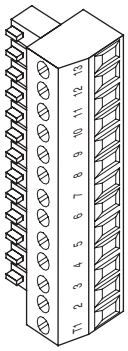
Input/Output	Connection Example	Required Parameter Changes
Analog Outputs +/-10V dc or +/-1.0V dc Used to drive analog meters displaying speed and current	Analog Outputs Indicating Motor Speed and Motor Current  	**Example: Using Analog Output 1, -10V to +10V to meter Motor RPM and direction:** • Adjust Parameter 812 [Anlg Out1 Offset] so that minimum speed creates a minimum signal (if the minimum speed is zero and the minimum signal is zero, enter a zero) • Adjust Parameter 817 [Anlg Out1 Scale] so that the maximum speed creates a maximum signal (if the maximum speed is 100% of motor base speed and the maximum signal is 10V dc, enter a value of 0.1) • Send the data to the Analog Output: Par 815 [Anlg Out1 Real] (the destination) linked to Par 300 [Motor Spd Fdbk] (the source) **Example: Using Analog Output 2, -10V to +10V to meter Motor Current** • Adjust Parameter 813 [Anlg Out2 Offset] so that minimum current creates a minimum signal (if the minimum current is zero and the minimum signal is zero, enter a zero) • Adjust Parameter 822 [Anlg Out2 Scale] so that the maximum current creates a maximum signal (if the maximum current is 200% of motor NP FLA and the maximum signal is 10V dc, enter a value of 2.0) • Send the data to the Analog Output Par 820 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source) • Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par2 [Motor NP FLA]/10V Output)

Table 3.F TB2 - Row T (Top) Terminals

	Terminal	Signal	Description	Related Parameter
	T13	Encoder Signal A	Primary encoder interface. 5 or 12V dc switch selectable (1), Nominal current draw per channel @ 12V dc 45 mA, @5V dc 32 mA Maximum input frequency for Encoders 0 & 1 is 500 kHz.	222, 230, 231, 232, 233, 234, 235, 236, 237, 238
	T12	Encoder Signal Not A		
	T11	Encoder Signal B		
	T10	Encoder Signal Not B		
	T9	Encoder Signal Z		
	T8	Encoder Signal Not Z		
	T7	Shield	Connection point for encoder shield.	
	T6	Digital Input #2	High speed 12-24V dc sinking digital input.	824, 830, 831, 832, 833, 839
	T5	Digital Input #2 Return		
	T4	Digital Input #3	High speed 12-24V dc sinking digital input.	824, 834, 835, 836, 837, 840
	T3	Digital Input #3 Return		
	T2	Power Supply +12V dc (A) (+)	5/12V dc power supply for primary encoder interface and high speed inputs. Rating 300 mA(2) (3)	
	T1	Power Supply +12V dc Return (A) (-)		

(1) Refer to Encoder Input Settings on page 3-17 for necessary dip switch settings.

(2) This power supply supports only the primary encoder interface and digital inputs. Do not use it to power circuits outside of the drive.

(3) To enable 5V supply, set Jumper J6 (located in the Main Control Board) to positions T2 and T3. Default 12V supply is set to T1 and T2.

Figure 3.3 TB2 - Row T (Top) Wiring Examples

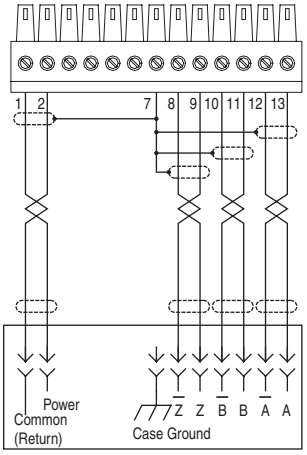
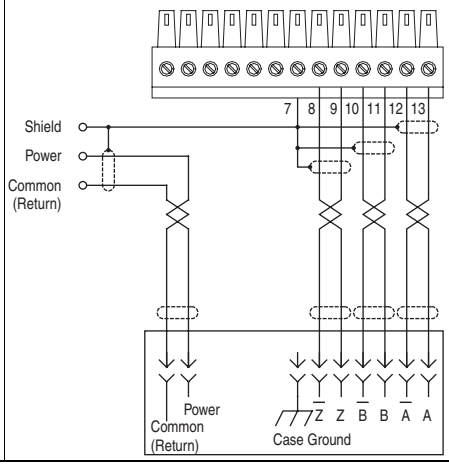
Input/Output	Connection Examples	Required Parameter Changes
Primary Encoder Interface - Supports 12V dc differential encoders with internal power supply. 5V dc differential encoders may require external power supply and special jumper settings. Refer to Main Control Board I/O and Encoder Settings on page 3-17 for external power supply and jumper settings. For 5V dc differential encoders with internal power supply, set Jumper J6 to positions T2 and T3.	Primary Encoder - using internal power supply  Primary Encoder - using external power supply 	**Example: Using Encoder 0 for Primary Motor Speed Feedback** • Set the value of Parameter 222 [Motor Fdbk Sel] to a value of 0 - “Encoder 0”, so the drive will use this encoder as the primary motor speed feedback device. • Set the value of Parameter 232 [Encoder0 PPR] to match the encoder’s resolution.

Figure 3.3 TB2 - Row T (Top) Wiring Examples

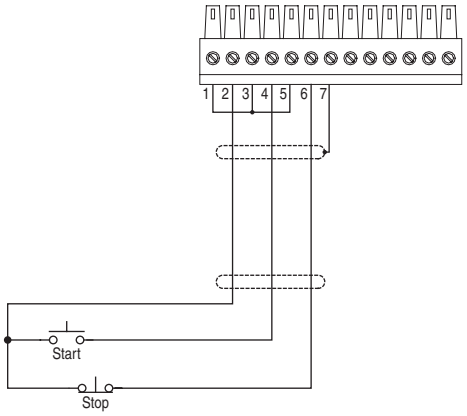
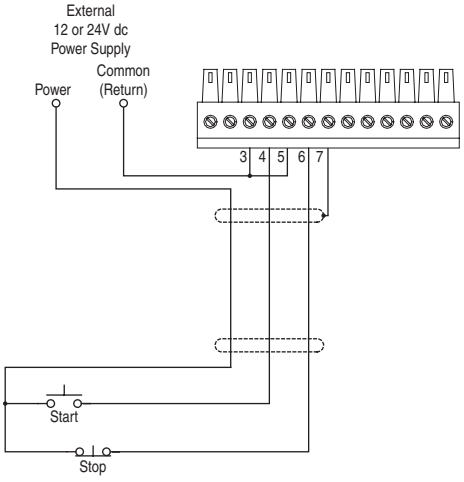
Input/Output	Connection Examples — 3-Wire Control	Required Parameter Changes
High Speed Inputs 12 or 24V dc	Sourcing High Speed Inputs, Used for 3 Wire Control - using the internal power supply 	**Example: Three Wire Control** • Set the value of Parameter 839 [DigIn 2 Sel] to 1 - "Normal Stop" • Set the value of Parameter 840 [DigIn 3 Sel] to 2 - "Start" • Set Parameter 153 [Control Options], bit 8 "3WireControl" = 1 **Note:** +12V and +24V are also available from TB1 Top 10 & 11.
	Sourcing High Speed Inputs, Used for 3 Wire Control - using an external power supply 	

Figure 3.3 TB2 - Row T (Top) Wiring Examples

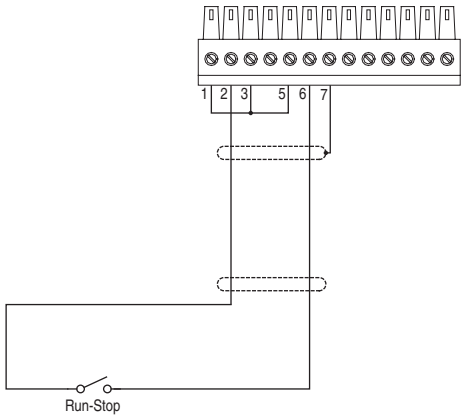
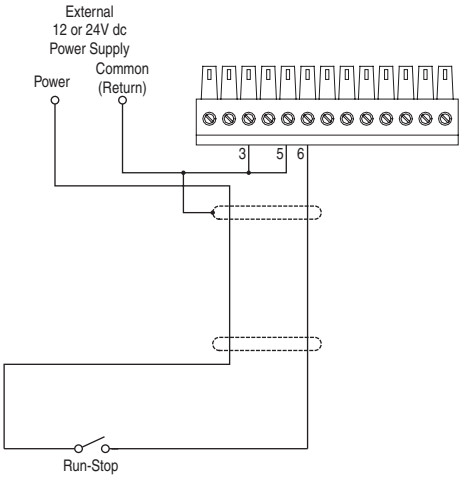
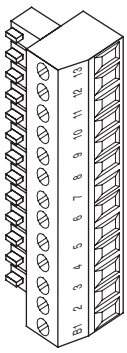
Input/Output	Connection Examples — 2-Wire Control	Required Parameter Changes
High Speed Inputs 12 or 24V dc	Sourcing High Speed Inputs, Used for 2 Wire Control - using the internal power supply 	**Example: Two Wire Control** • Set the value of Parameter 839 [DigIn 2 Sel] to 3 -"Run" • Set Parameter 153 [Control Options], bit 9 "2W CoastStop" = 1, to make the drive coast stop when Digital Input 2 goes low • Reset Parameter 153 [Control Options], bit 9 "2W CoastStop" = 0, to make the drive ramp stop when Digital Input 2 goes low • Reset Parameter 153 [Control Options], bit 8 "3WireControl" = 0, for 2 wire control
	Sourcing High Speed Inputs, Used for 2 Wire Control - using an external power supply 	**Note:** +12V and +24V are also available from TB1 Top 10 & 11.

Table 3.G TB2 - Row B (Bottom) Terminals

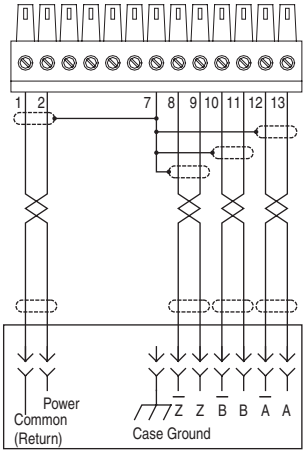
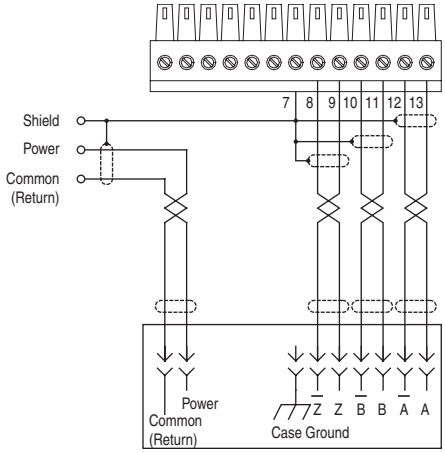
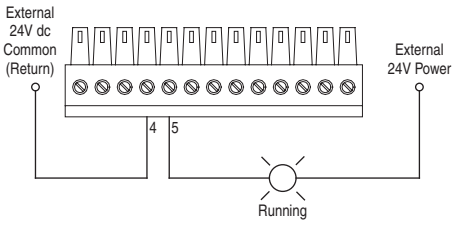
	Terminal	Signal	Description	Related Parameter
	B13	Encoder Signal A	Secondary encoder interface. 5 or 12V dc switch selectable (1), Nominal current draw per channel @ 12V dc 45 mA, @5V dc 32 mA Maximum input frequency for Encoders 0 & 1 is 500 kHz.	222, 240, 241, 242, 243, 244, 245, 246, 247, 248
	B12	Encoder Signal Not A		
	B11	Encoder Signal B		
	B10	Encoder Signal Not B		
	B9	Encoder Signal Z		
	B8	Encoder Signal Not Z		
	B7	Shield	Connection point for encoder shield.	
	B6	Unused		
	B5	Relay Output	Relay contact output. Rating: 5A @ 24V dc Resistive, 2A 24V dc Inductive	824, 841, 842
	B4	Relay Output Return		
	B3	Unused		
	B2	Power Supply +12V dc (B) (+)	15/2V dc power supply for secondary encoder interface. Rating 300 mA(2) (3)	
	B1	Power Supply +12V dc Return (B) (-)		

(1) Refer to Encoder Input Settings on page 3-17 for necessary dip switch settings.

(2) This power supply supports only the secondary encoder interface. Do not use it to power circuits outside of the drive

(3) To enable 5V supply, set Jumper J6 (located in the Main Control Board) to positions T2 and T3. Default 12V supply is set to T1 and T2.

Figure 3.4 TB2 - Row B (Bottom) Wiring Examples

Input/Output	Connection Example	Required Parameter Changes
Secondary Encoder Interface - Supports 12V dc differential encoders with internal power supply. 5V dc differential encoders require external power supply and special jumper settings. Refer to Auxiliary Power Supply on page 3-16 for external power supply and jumper settings. For 5V dc differential encoders with internal power supply, set Jumper J6 to positions T2 and T3.	Secondary Encoder - using internal power supply 	**Example: Using Encoder 1 for Primary Motor Speed Feedback** • Set the value of Parameter 222 [Motor Fdbk Sel] to 1 - "Encoder 1", so the drive will use this encoder as the primary motor speed feedback device • Set the value of Parameter 242 [Encoder1 PPR] to match the encoder's resolution
	Secondary Encoder - using external power supply 	
Auxiliary Output - Relay contact output	Auxiliary Output, Used to Indicate Running 	**Example: Using Auxiliary Output to Indicate Running** • Link Parameter 155 [Logic Status], the source, to Parameter 841 [Relay Out Data], the sink • Set Parameter 842 [Relay Out Bit] to 1, so that Parameter 155 [Logic Status], bit 1 "Running" will control the output.

Hardware Enable Circuitry

The PowerFlex 700S provides a dedicated hardware enable input for applications that require the drive to be disabled without software interpretation.

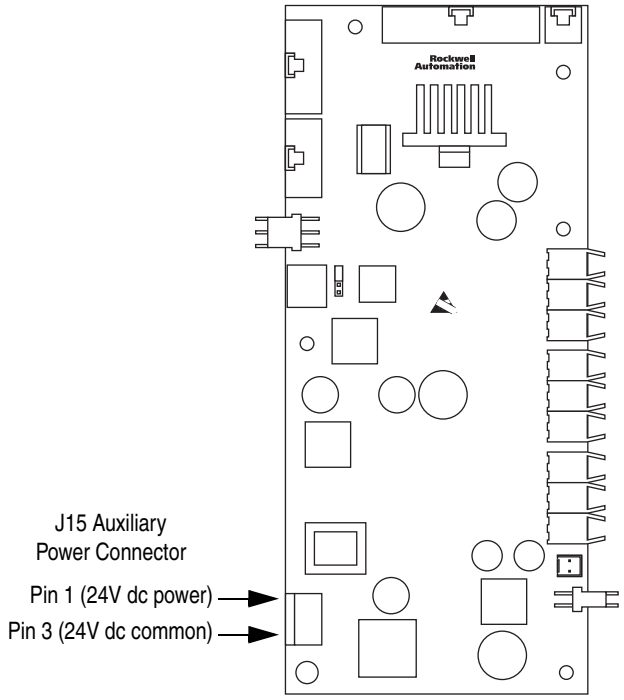
Auxiliary Power Supply

You may use an auxiliary power supply to keep the 700S Control Assembly energized, when input power is de-energized. This allows the Main Control Board, DriveLogix controller and any feedback option cards to continue operation. Connect auxiliary power to J15 on the Fiber Optic Interface board. You must set parameter 153 [Control Options], bit 17 “Aux Pwr Sply” to enable this feature.

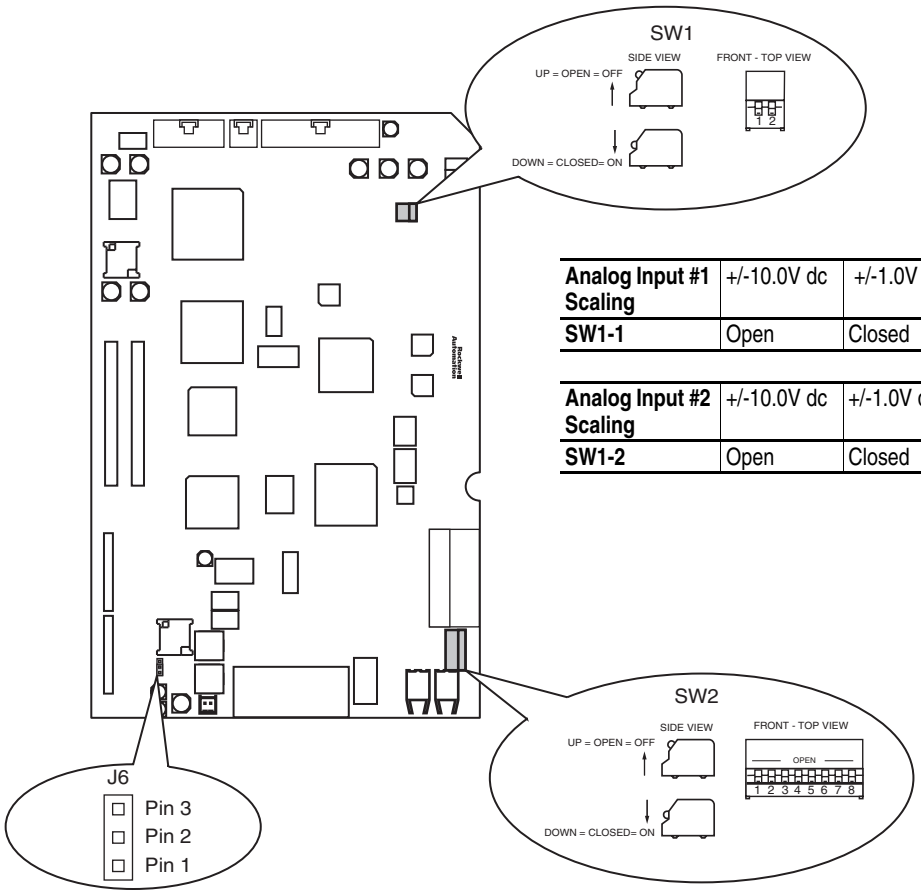
Table 3.H Auxiliary Power Supply Specifications

Voltage	Current (Min)	Power (Min)
24V dc ± 5%	3A	75W

Figure 3.5 PowerFlex Fiber Optic Interface Board



Main Control Board I/O and Encoder Settings



Analog Input #1 Scaling	+/-10.0V dc	+/-1.0V dc
SW1-1	Open	Closed

Analog Input #2 Scaling	+/-10.0V dc	+/-1.0V dc
SW1-2	Open	Closed

Encoder Power Supply Voltage	Jumper Position
5V dc	2-3
12V dc	1-2

Primary Encoder	SW2-2	SW2-4	SW2-6
5V dc Operation	Closed	Closed	Closed
12V dc Operation	Open	Open	Open

Secondary Encoder	SW2-1	SW2-3	SW2-5
5V dc Operation	Closed	Closed	Closed
12V dc Operation	Open	Open	Open

Analog Input Settings

Switch SW1-1 configures the scaling of Analog Input #1. Switch SW1-2 configures the scaling of Analog Input #2. Open the switch for +/-10.0V dc operation. Close the switch for +/-1.0V dc operation.

Encoder Input Settings

Dip switch SW2 on the main control board configures the encoder inputs for 5V dc or 12V dc operation. Switches SW2-2, 4, and 6 are for the primary encoder. Set these switches to match the encoder output

specifications. Open these switches for 12V dc operation, close them for 5V dc operation.

Switches SW2-1, 3, and 5 are for the secondary encoder. Set these switches to match the encoder output specifications. Open these switches for 12V dc operation, close them for 5V dc operation.

Encoder Output Settings

Jumper J6 on the main control board configures the encoder power supply for either 5V dc or 12V dc operation. Place the jumper on pins 1 and 2 for 12V operation. Place it on pins 2 and 3 for 5V dc operation.

Connecting SynchLink

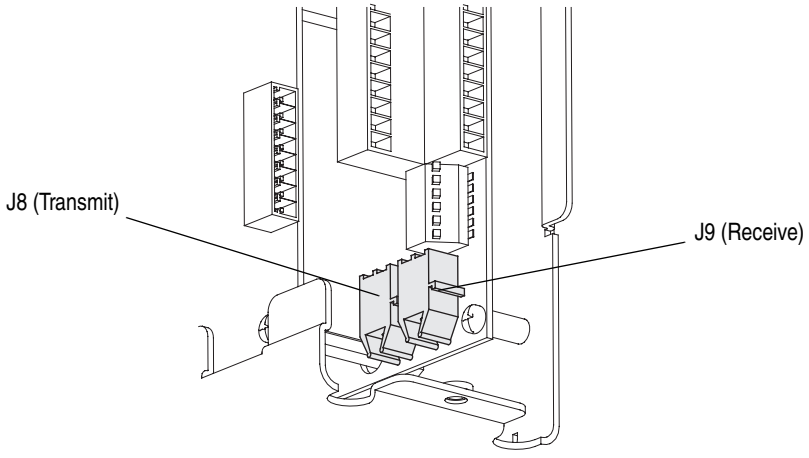
SynchLink provides high-speed synchronization and communication between multiple PowerFlex 700S drives (or other products with SynchLink capability).

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

Refer to publication number 1756-TD008, *SynchLink System Design Guide,* when planning and connecting the SynchLink network.

Connect cables to J9 (receive) and J8 (transmit) connectors on the bottom of the Main Control Board. Push the plug into the socket until it produces an audible click.



Important: Do not overtighten tie-wraps.

Table 3.I SynchLink Cables and Accessories

Description	Cat. No.
2 x 1 M Fiber Optic Link	1403-CF001
2 x 3 M Fiber Optic Link	1403-CF003
2 x 5 M Fiber Optic Link	1403-CF005
10 M Fiber Optic Link	1403-CF010
20 M Fiber Optic Link	1403-CF020
50 M Fiber Optic Link	1403-CF050
100 M Fiber Optic Link	1403-CF100
250 M Fiber Optic Link	1403-CF250
500 M Fiber Optic Bulk	1403-CFBLK
SynchLink Fiber-Hub, 1 input, Base	1751-SLBA
SynchLink Fiber-Hub, 4 output, “Star” Splitter	1751-SL4SP
SynchLink Bypass Switch	1751-SLBP/A

Table 3.J Fiber Optic Cable Assembly

Specification	
Connecting Cables	200/230 micron HCS (Hard Clad Silica) • Versalink V-System • Lucent Technologies, • Specialty Fibers Technology Division
Maximum Cable Length	300 meters with no more than one splice or one adapter
Minimum Cable Length	1 meter
Minimum inside bend radius	25.4mm (1 in.) Any bends with a shorter inside radius can permanently damage the fiber optic cable. Signal attention increases with decreased inside bend radius.
Operating Wavelength	650 nm (Red)
Data Rate	5 Mbps
Maximum Node Count	• 10 - Daisy Chain • 256 - Star Configuration

Notes:

Control Wiring for PowerFlex 700S Drives with Phase II Control

I/O Wiring

Important points to remember about I/O wiring:

- Always use tinned copper wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
- 4100CCF3 Flex I/O cable for use with DriveLogix is 3 ft. maximum length.

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Table 4.A Recommended Control Wire

Type		Wire Type(s)	Description	Insulation Rating
Digital I/O	Un-shielded	Per US NEC or applicable national or local code	–	300V, 60° C (140° F), Minimum
	Shielded	Multi-conductor shielded cable such as Belden 8770 (or equiv.)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	
Standard Analog I/O	Belden 8760/9460 (or equiv.)		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain (5).	300V, 75-90 °C (167-194 °F)
Remote Pot	Belden 8770 (or equiv.)		0.750 mm^2 (18 AWG), 3 cond., shielded	
Encoder/ Pulse I/O Less 30.5 m (100 ft.)	Combined:	Belden 9730 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
Encoder/ Pulse I/O 30.5 m (100 ft.) to 152.4 m (500 ft.)	Signal:	Belden 9730/9728 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9892 (3)	0.330 mm^2 or 0.500 mm^2 (3)	
Encoder/ Pulse I/O 152.4 m (500 ft.) to 259.1 m (850 ft.)	Signal:	Belden 9730/9728 (or equivalent) (1)	0.196 mm^2 (24 AWG), individually shielded.	
	Power:	Belden 8790 (2)	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9773/9774 (or equivalent) (4)	0.750 mm^2 (18 AWG), individually shielded pair.	
EMC Compliance	Refer to EMC Instructions on page 1-7 for details.			

(1) Belden 9730 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9728 (or equivalent).

(2) Belden 8790 is 1 shielded pair.

(3) Belden 9892 is 3 individually shielded pairs (3 channel), 0.33 mm^2 (22 AWG) plus 1 shielded pair 0.5 mm^2 (20 AWG) for power.

(4) Belden 9773 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9774 (or equivalent).

(5) If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

I/O Terminal Blocks

Wiring the Main Control Board I/O Terminals

Terminal blocks TB1 and TB2 contain connection points for all inputs, outputs and standard encoder connections. Both terminal blocks reside on the Main Control Board.

Remove the terminal block plug from the socket, and make connections.

Important: For NEMA/UL Type 1 applications, all wiring must be routed through the conduit plate on the drive. Route any wires from the expanded cassette to the base cassette and out of the drive.

Reinstall the plug when wiring is complete. The terminal blocks have keys, which make it difficult to insert a terminal plug into the wrong socket.

Table E Control & Encoder Terminal Block Specifications

		Wires Size Range[1]		Torque	
Name	**Description**	Maximum	Minimum	Maximum	Recommended
I/O Blocks	Signal & Encoder power connections	1.5 mm^2 (16 AWG)	0.14 mm^2 (28 AWG)	0.25 N-m (2.2 lb.-in.)	0.22 N-m (1.9 lb.-in.)

(1) Maximum/minimum sizes the terminal block will accept - these are not recommendations.

Main Control Board I/O Terminal Locations

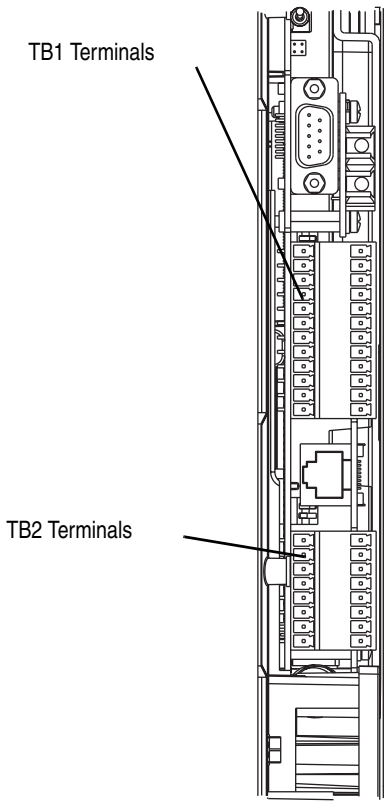
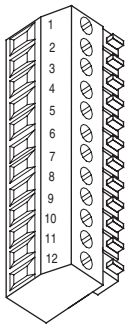
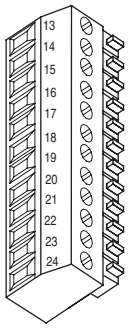


Table F TB1 Terminals

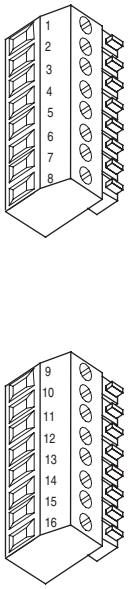




Terminal	Signal	Factory Default	Description
1	Analog Input 1 Comm.	(Volt)	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20k Ohm impedance at Volt; 500 Ohm impedance at mA(1)
2	Analog Input 1 (+/-)		
3	Shield	NA	Analog Input Shield
4	Analog Input 2 Comm.	(Volt)	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20k Ohm impedance at Volt; 500 Ohm impedance at mA
5	Analog Input 2 (+/-)		
6	Analog Input 3 [NTC-] Comm.	(Volt)	Differential input, 0-10V, 10 bit (for motor control mode FVC2, this is the temperature adaptation input).
7	Analog Input 3 [NTC+]		
8	Shield	NA	Analog Output Shield
9	Analog Output 1 (-)	(Volt)	Bipolar, differential output, +/-10V, 0-20 mA, 11 bit + sign 2k Ohm minimum load
10	Analog Output 1 (+)		
11	Analog Output 2 (-)	(Volt)	
12	Analog Output 2 (+)		
13	+10V Reference	NA	Rating: 20 mA maximum load (Recommend 5k Ohm pot)
14	Reference Common	NA	
15	-10V Reference	NA	
16	Encoder A	NA	Normal current draw per channel: 20 mA
17	Encoder A (Not)	NA	
18	Encoder B	NA	
19	Encoder B (Not)	NA	
20	Encoder Z	NA	
21	Encoder Z (Not)	NA	
22	Encoder Reference (+)	NA	12 or 5V DC power supply for primary encoder interface Rating: 300 mA maximum
23	Encoder Reference (-)	NA	
24	Encoder Shield	NA	Connection point for encoder shield

(1) The analog inputs are not isolated. However, the analog inputs can be connected in series when using current mode. Note that at 20mA the voltage source must be capable of providing 10V dc at the drive terminals for one drive - - 20V dc is required for two drives and 30V dc is required for three drives.

Table G TB2 Terminals

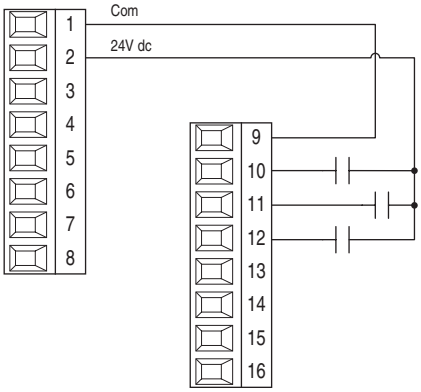
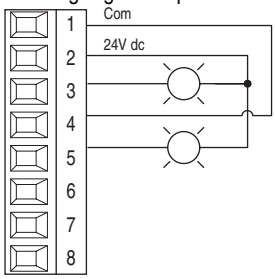
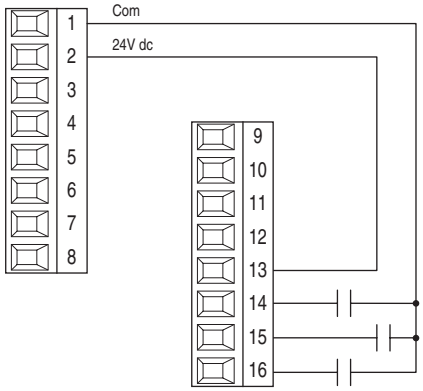
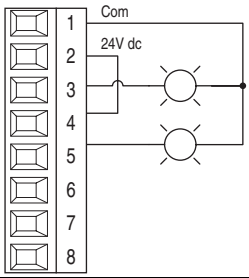


Terminal	Signal	Factory Default	Description
1	24V DC Common (-)	NA	Drive supplied 24V DC logic input power Rating: 300 mA maximum load
2	24V DC Source (+)	NA	
3	Digital Output 1		24V DC Open Collector (sinking logic) Rating: Internal Source = 150 mA max. External Source = 750 mA
4	Digital Output 1/2 Com	NA	Common for Digital Output 1 & 2
5	Digital Output 2		24V DC Open Collector (sinking logic) Rating: Internal Source = 150 mA max. External Source = 750 mA
6	Relay Output 3 (NC)		Relay contact output Rating: 115V AC or 24V DC = 2 A max. Inductive/Resistive
7	Relay Output 3 Com	NA	
8	Relay Output 3 (NO)		
9	Digital Input 1-3 Com	NA	Common for Digital Inputs 1-3
10	Digital Input 1		High speed 12V or 24V DC[1], sinking Load:15 mA at 24V DC
11	Digital Input 2		
12	Digital Input 3		Load:15 mA at 24V DC sourcing
13	Digital Input 4-6 Com	NA	Common for Digital Inputs 4-6
14	Digital Input 4		Load: 10 mA at 24V DC sinking/sourcing Load: 7.5 mA at 115V AC **Note**: The 115 VAC Digital Inputs can withstand 2 milliamps of leakage current without turning on. If an output device has a leakage current greater than 2 milliamps a burden resistor is required. A 68.1K ohm resistor with a 0.5 watt rating should be used to keep the 115 VAC output below 2 milliamps.
15	Digital Input 5		
16	Digital Input 6	HW Enable	

(1) Digital Inputs 1 and 2 are configured for 12V or 24V DC via DIP switches S3-1 and S3-2, respectively. 24V DC is the default setting.

I/O Wiring Examples

Table H TB2 Terminals — Digital Wiring Examples

Input/Output	Connection Example
Digital Inputs used for enable and precharge control. *Note:* **24V DC Supply** - supports only on-board digital inputs. Do not use for circuits outside the drive. *Note*: The factory default for Digital Inputs is 24V. This must be switched in order to use 115V.	Sourcing Digital Inputs - Internal Power Supply  Sourcing Digital Outputs - Internal Power Supply  Sinking Digital Inputs - Internal Power Supply  Sinking Digital Output - Internal Power Supply 

Sourcing and Sinking Definitions

The digital inputs and digital outputs of the PowerFlex 700S AC drive support Sourcing or Sinking configuration. Typically, digital inputs are sourcing devices and digital outputs are sinking devices. The following definitions apply throughout this section:

- **Sourcing a Digital Input** - The digital input common (return) is connected to the power supply common. Applying a positive voltage to the digital input will cause it to activate (pull up).
- **Sinking a Digital Input** - The digital input common (return) is connected to the power supply positive voltage. Applying 0V or common to the digital input will cause it to activate (pull down).
- **Sourcing a Digital Output** - The digital output common (return) is connected to the power supply common. The device to be controlled by the digital output is connect to the positive voltage and the device common is connected to the digital output.
- **Sinking a Digital Output** - The digital output common (return) is connected to the power supply positive voltage. The digital output is connect to the device to be controlled and the device common is connected to the power supply common.

Note:
Digital Inputs 1-3 can only be configured as sourcing inputs. Digital Inputs 4-6 can be configured as sourcing or sinking inputs.

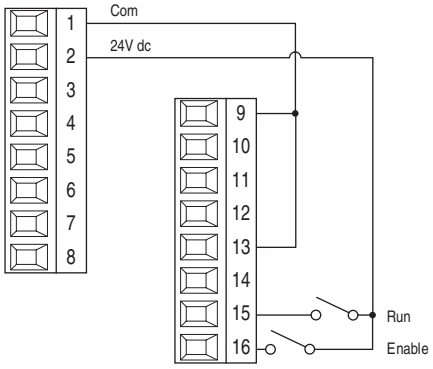
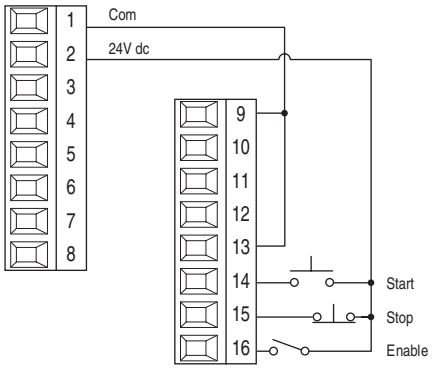
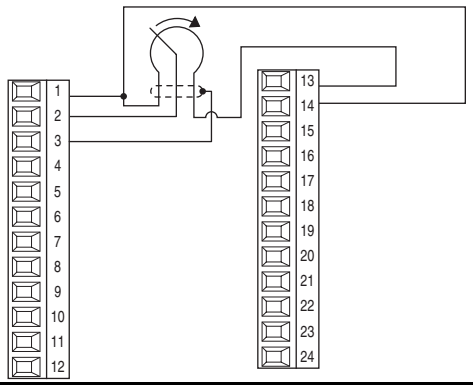
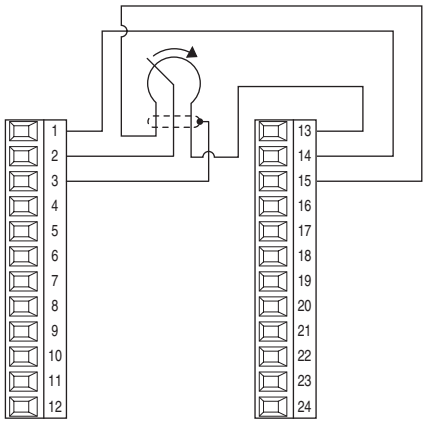
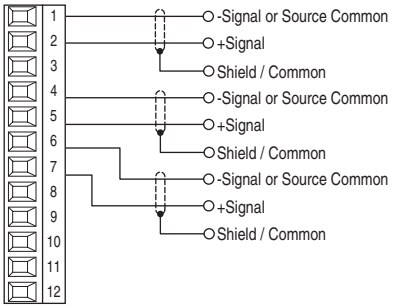
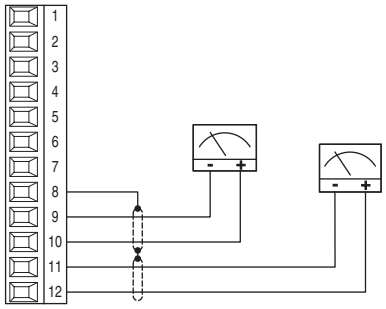
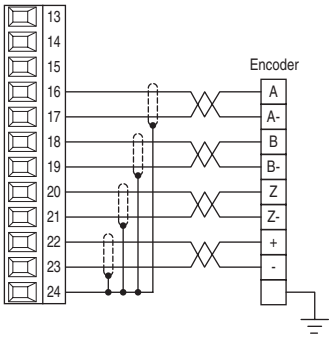
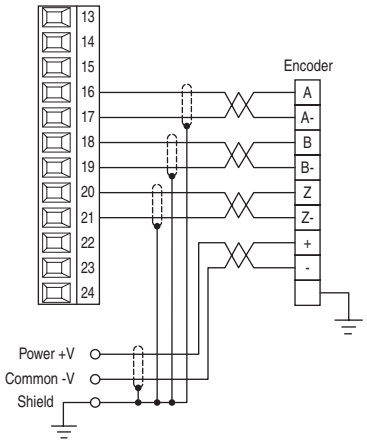
Input/Output	Connection Example	
Digital Inputs 24V DC	Sourcing Digital Inputs - Internal Power Supply, 2-Wire Control 	**Required Parameter Changes** • Set the value of Par 829 [Dig In5 Sel] to a value of 7 - "Run" • Par 153 [Control Options], bit 8 "3WireControl" will automatically be off (0) for 2-wire control. • Set Par 168 [Normal Stop Mode] for the desired stopping mode: 0 = Ramp Stop 1 = CurLim Stop 2 = Coast Stop
Digital Inputs 24V DC	Sourcing Digital Inputs- Internal Power Supply, 3-Wire 	• Set the value of Par 829 [Dig In5 Sel] to a value of 14 - "Normal Stop" • Set Par 828 [Dig In4 Sel] to a value of 5 - "Start" • Par 153 [Control Options], bit 8 "3WireControl" will automatically be off (0) for 2-wire control. • Set Par 168 [Normal Stop Mode] for the desired stopping mode: 0 = Ramp Stop 1 = CurLim Stop 2 = Coast Stop

Table I TB1 Terminals— Analog Wiring Examples

Input/Output	Connection Example	
0-10V Analog Input	0-10V Analog Input - Internal Source 	**Required Parameter Changes** na

Input/Output	Connection Example	
0-10V Analog Input	0-10V Analog Input - Bi-Polar 	na
0-10V Analog Input	0-10V Analog Input - External Source 	**Required Parameter Changes** na
Analog Output +/-10V DC Used to drive analog meters displaying speed and current	0-10V Analog Output 	**Using Analog Out 1, -10V to + 10V to meter Motor RPM and direction:** • Send the data to the Analog Output Par 833 [Anlg Out1 Real] (the destination) linked to Par 71 [Filtered SpdFdbk] (the source) • Scale the Output to the source parameter Par 835 [Anlg Out1 Scale] = 175 (Par 4 [Motor NP RPM] = 1750 / 10V) **Using Analog Out 2, -10V to + 10V to meter Motor Current:** • Send the data to the Analog Output Par 840 [Anlg Out2 Real] (the destination) linked to Par 308 [Output Current] (the source) • Scale the Output to the source parameter Par 822 [Anlg Out2 Scale] = xx (Par 2 [Motor NP FLA] / 10 V Output)

Input/Output	Connection Example	
Primary Encoder Interface - Supports 5V/12V DC differential encoders with internal power supply. Used as primary closed loop speed feedback,	Primary Encoder - Internal Supply 	**Using Encoder 0 as speed feedback:** • Par 222 [Motor Fdkbk Sel] = 0 - “Encoder 0” (default) • Par 232 [Encoder0 PPR] = Pulses/Rev for installed encoder
	Primary Encoder - External Supply 	

Hard Enable Circuitry

The PowerFlex 700S provides a dedicated hardware enable input for applications that require the drive to be disabled without software interpretation.

Auxiliary Power Supply

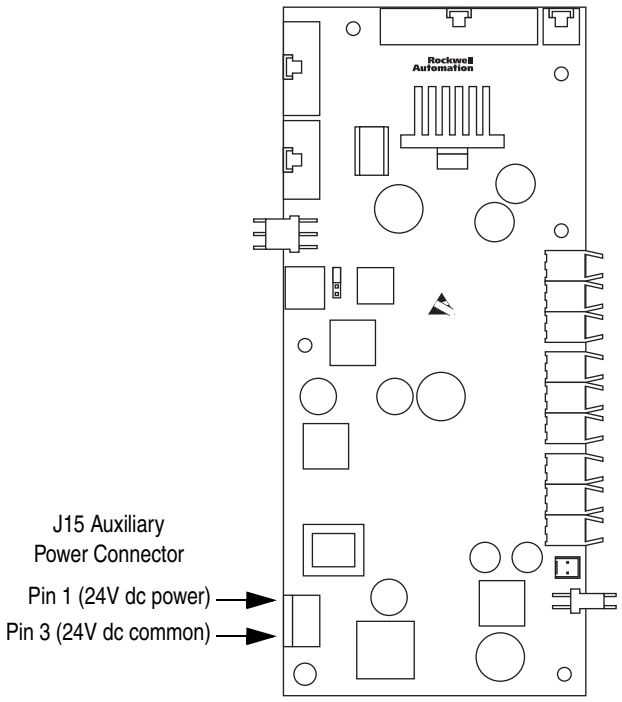
You may use an auxiliary power supply to keep the 700S Control Assembly energized, when input power is de-energized. This allows the Main Control Board, DriveLogix controller and any feedback option cards to continue operation. Connect auxiliary power to J15 on the Fiber Optic Interface board. You must set parameter 153 [Control Options], bit 17 “Aux Pwr Sply” to enable this feature.

Important: For drives manufactured prior to June 2006, the Voltage Feedback board provides the bulk 24 volts for the Fiber Optic Fiber Optic Interface board. If the auxiliary power supply (24 volts) is greater than the Voltage Feedback board (24 volts) then the switch mode power supply on the Voltage Feedback board will shut down. If the auxiliary power supply has an adjustable voltage, then the voltage should be lowered (23.75). This will allow the Voltage Feedback board power supply to supply the 24 volts. If the auxiliary power supply cannot be adjusted, then a 500 ohm resistor needs to be added to the Voltage Feedback board. In this case, please contact Drives Technical Support for details.

Table 4.B Auxiliary Power Supply Specifications

Voltage	Current (Min)	Power (Min)
24V dc ± 5%	3A	75W

Figure 4.1 PowerFlex Fiber Optic Interface Board



DIP Switch Settings

ATTENTION: The DIP switches for Digital Inputs 4 - 6 are set to 24V DC at the factory. If you are running a 115V AC input application, the switches must be set as indicated below before applying power to the drive or damage to the Main Control board may occur.

Figure 3 Main Control Board Dip Switches

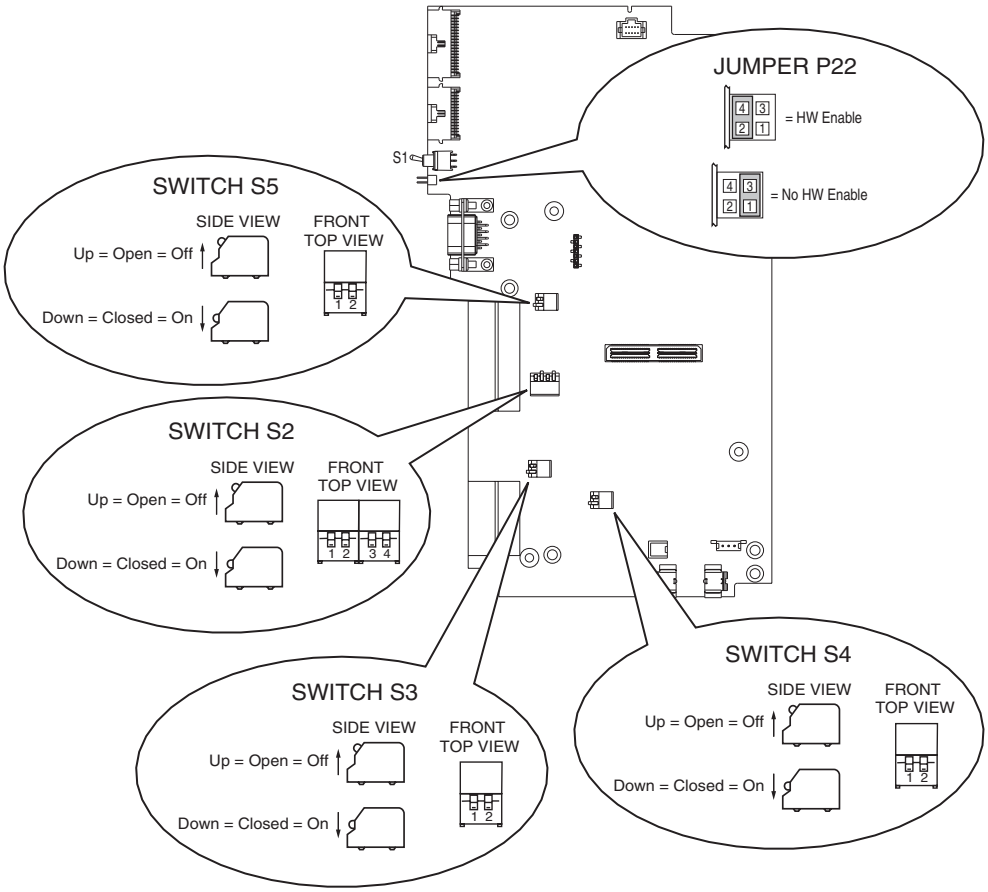


Table E Switch Settings

Function	Default	Switch	Open	Closed	Notes
Configuring Digital Input 6 for Hardware Enable (HW Enbl)	pin 2-4 HW Enbl	P22 Jumper	pin 2-4 HW Enbl	pin 1-3 No Enbl	No Jmpr = HW Enbl
Analog Input 1	Voltage	S5-2	Voltage	Current	Change with Power Off
Analog Input 2	Voltage	S5-1	Voltage	Current	Change with Power Off
Digital Inputs 4-6 Voltage	24V DC	S4-1, S4-2	115V AC	24V DC	Change with Power Off
Digital Input 1 Voltage	24V DC	S3-1	24V DC	12V DC	Change with Power Off
Digital Input 2 Voltage	24V DC	S3-2	24V DC	12V DC	Change with Power Off

Function	Default	Switch	Open	Closed	Notes
Encoder Supply Voltage	12V DC	S2-4	12V DC	5V DC	Change with Power Off Set all switches the same
Encoder Signal A Voltage	12V DC	S2-1	12V DC	5V DC	
Encoder Signal B Voltage	12V DC	S2-2	12V DC	5V DC	
Encoder Signal Z Voltage	12V DC	S2-3	12V DC	5V DC	

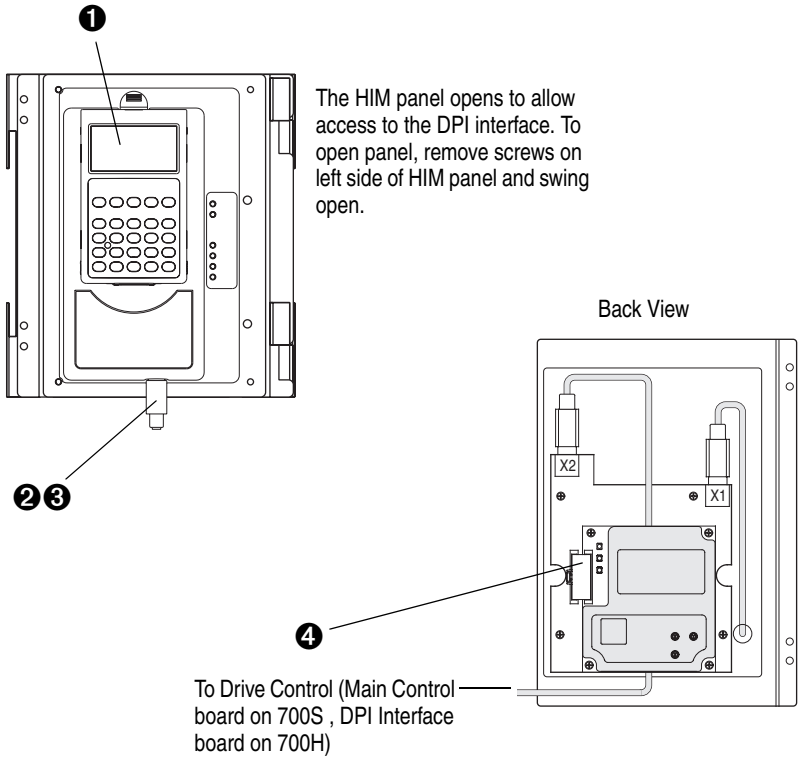
Function	Down	Switch	Up	Center	Notes
DriveLogix Processor	Run	S1	Prog	Remote	Processor Mode

Please note there are two separate values for an encoder.

Communication Options

Communication Module Locations

Figure 5.1 DPI Port Locations



No.	Connector	Description
❶	DPI Port 1	HIM connection when installed in the drive.
❷	DPI Port 2	Cable connection for handheld and remote options.
❸	DPI Port 3 or 2	Splitter cable connected to DPI Port 2 provides additional port.
❹	DPI Port 5	Cable connection for communications adapter.

Note: DPI Port 4 is not available.

Communication Configurations

Typical Programmable Controller Configurations

Important: If block transfers are programmed to continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous transfers. If attribute 9 is selected, each program scan will complete a write to the drives non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do Not assign attribute 9 to continuous block transfers. Refer to the individual communications adapter User Manual for details.

Logic Command/Status Words

Figure 5.2 PowerFlex 700H Logic Command Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Command**	**Description**
															x	Stop[1]	0 = Not Stop 1 = Stop
														x		Start[1][2]	0 = Not Start 1 = Start
													x			Jog	0 = Not Jog 1 = Jog
												x				Clear Faults	0 = Not Clear Faults 1 = Clear Faults
										x	x					Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Present Direction
									x							Local Control	0 = No Local Control 1 = Local Control
								x								MOP Increment	0 = Not Increment 1 = Increment
						x	x									Accel Rate	00 = No Command 01 = Use Accel Time 1 10 = Use Accel Time 2 11 = Use Present Time
				x	x											Decel Rate	00 = No Command 01 = Use Decel Time 1 10 = Use Decel Time 2 11 = Use Present Time
	x	x	x													Reference Select[3]	000 = No Command 001 = Ref. 1 (Ref A Select) 010 = Ref. 2 (Ref B Select) 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
x																MOP Decrement	0 = Not Decrement 1 = Decrement

(1) A “0 = Not Stop” condition (logic 0) must first be present before a “1 = Start” condition will start the drive. The Start command acts as a momentary Start command. A “1” will start the drive, but returning to “0” will not stop the drive.

(2) This Start will not function if a digital input (Pars 361-366) is programmed for 2-Wire Control (option 7, 8 or 9).

(3) This Reference Select will not function if a digital input (Pars. 361-366) is programmed for “Speed Sel 1, 2 or 3” (option 15, 16 or 17). Note that Reference Selection is “Exclusive Ownership.”

Figure 5.3 PowerFlex 700H Logic Status Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	**Status**	**Description**
															x	Ready	0 = Not Ready 1 = Ready
														x		Active	0 = Not Active 1 = Active
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Alarm	0 = No Alarm 1 = Alarm
								x								Fault	0 = No Fault 1 = Fault
							x									At Speed	0 = Not At Reference 1 = At Reference
				x	x	x										Local Control[1]	000 = Port 0 (TB) 001 = Port 1 010 = Port 2 011 = Port 3 100 = Port 4 101 = Port 5 110 = Reserved 111 = No Local
x	x	x	x													Reference Source	0000 = Ref A Auto 0001 = Ref B Auto 0010 = Preset 2 Auto 0011 = Preset 3 Auto 0100 = Preset 4 Auto 0101 = Preset 5 Auto 0110 = Preset 6 Auto 0111 = Preset 7 Auto 1000 = Term Blk Manual 1001 = DPI 1 Manual 1010 = DPI 2 Manual 1011 = DPI 3 Manual 1100 = DPI 4 Manual 1101 = DPI 5 Manual 1110 = Reserved 1111 = Jog Ref

(1) See “Owners” for further information.

Figure 5.4 PowerFlex 700S Logic Command Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Command	Description
															x	Normal Stop	0 = Not Normal Stop 1 = Normal Stop
														x		Start[1]	0 = Not Start 1 = Start
													x			Jog 1	0 = Not Jog using [Jog Speed 1] 1 = Jog using [Jog Speed 1]
												x				Clear Fault[2]	0 = Not Clear Fault 1 = Clear Fault
										x	x					Unipolar Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Direction Control
									x							Reserved	
								x								Jog 2	0 = Not Jog using [Jog Speed 2] 1 = Jog using [Jog Speed 2]
							x									Current Limit Stop	0 = Not Current Limit Stop 1 = Current Limit Stop
						x										Coast Stop	0 = Not Coast to Stop 1 = Coast to Stop
					x											Reserved	
				x												Reserved	
			x													Spd Ref Sel0	
		x														Spd Ref Sel1	
	x															Spd Ref Sel2	
x																Reserved	

Bits				
14	13	12		
0	0	0	=	Spd Ref A
0	0	1	=	Spd Ref B
0	1	0	=	Preset 2
0	1	1	=	Ref. 3 (Preset 3)
1	0	0	=	Ref. 4 (Preset 4)
1	0	1	=	Ref. 5 (Preset 5)
1	1	0	=	Ref. 6 (Preset 6)
1	1	1	=	Ref. 7 (Preset 7)

(1) A Not Stop condition (logic bit 0 = 0, logic bit 8 = 0, and logic bit 9 = 0) must first be present before a 1 = Start condition will start the drive.

(2) To perform this command, the value must switch from “0” to “1.”

Figure 5.5 PowerFlex 700S Logic Status Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Status	Description
															x	Active	0 = Not Active 1 = Active
														x		Running	0 = Not Running 1 = Running
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Jogging	0 = Not Jogging 1 = Jogging
								x								Fault	0 = No Fault 1 = Fault
							x									Alarm	0 = No Alarm 1 = Alarm
						x										Flash Mode	0 = Not in Flash Mode 1 = In Flash Mode
					x											Run Ready	0 = Not Ready to Run 1 = Ready to Run
				x												At Limit(1)	0 = Not At Limit 1 = At Limit
			x													Tach Loss Sw	0 = Not Tach Loss Sw 1 = Tach Loss Sw
		x														At Zero Spd	0 = Not At Zero Speed 1 = At Zero Speed
	x															At Setpt Spd	0 = Not At Setpoint Speed 1= At Setpoint Speed
x																Enable	0 = Not Enabled 1 = Enabled

(1) See Parameter 304 - [Limit Status] in the PowerFlex 700S drive for a description of the limit status conditions.

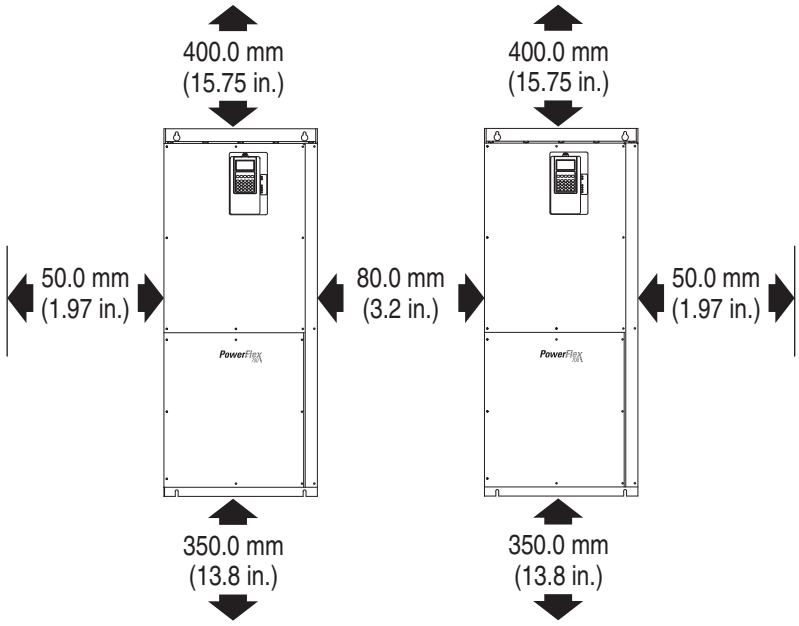
Notes:

Frame 9 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances



Refer to Figure 6.1 for detailed dimension information.

Operating Temperatures

Frame 9 drives require a minimum of 1300 m^3/h (765 cfm) of cooling air.

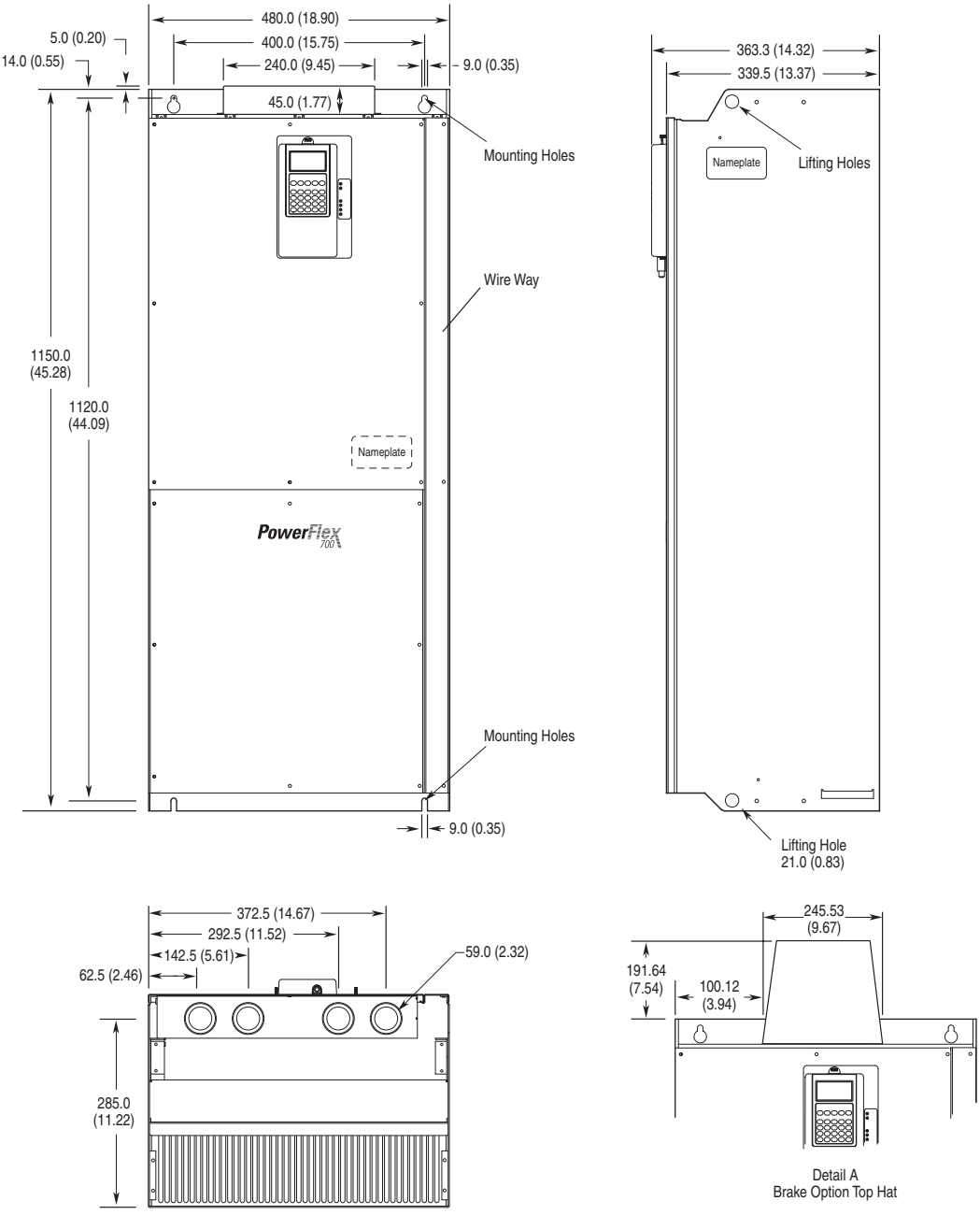
PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H	All	All	0 to 40° C (32 to 104° F)	0 to 50° C (32 to 122° F)
700S	400/480V AC (540/650V DC)	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	170	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
		208	0 to 35° C (32 to 95° F)	0 to 40° C (32 to 104° F)

Nameplate Location

Refer to Figure 6.1 below.

Dimensions

Figure 6.1 Frame 9 Dimensions

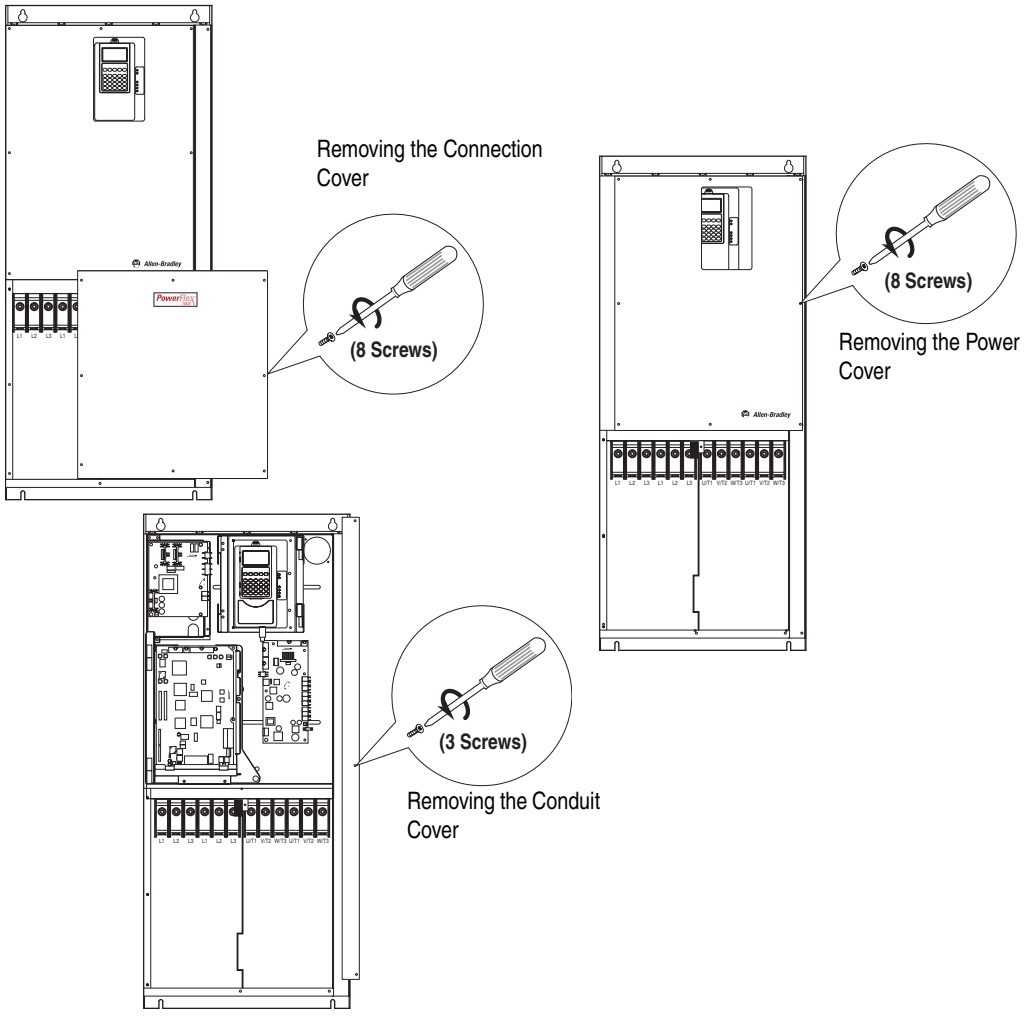


Dimensions are in millimeters and (inches).

Lifting and Mounting Frame 9 Drives

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions.

Removing the Protective Covers



Ungrounded, Unbalanced or High Resistive Ground Installations

CE frame 9 drives are equipped with common mode capacitors that are referenced to ground. Operating a CE frame 9 drive on a resistive ground or ungrounded distribution system could result in drive damage.

ATTENTION: If you intend to operate a Frame 9 drive on a resistive ground or ungrounded distribution system, you must order a non-CE PowerFlex drive.

Power Wiring

Table 6.A Frame 9 Power Terminal Specifications

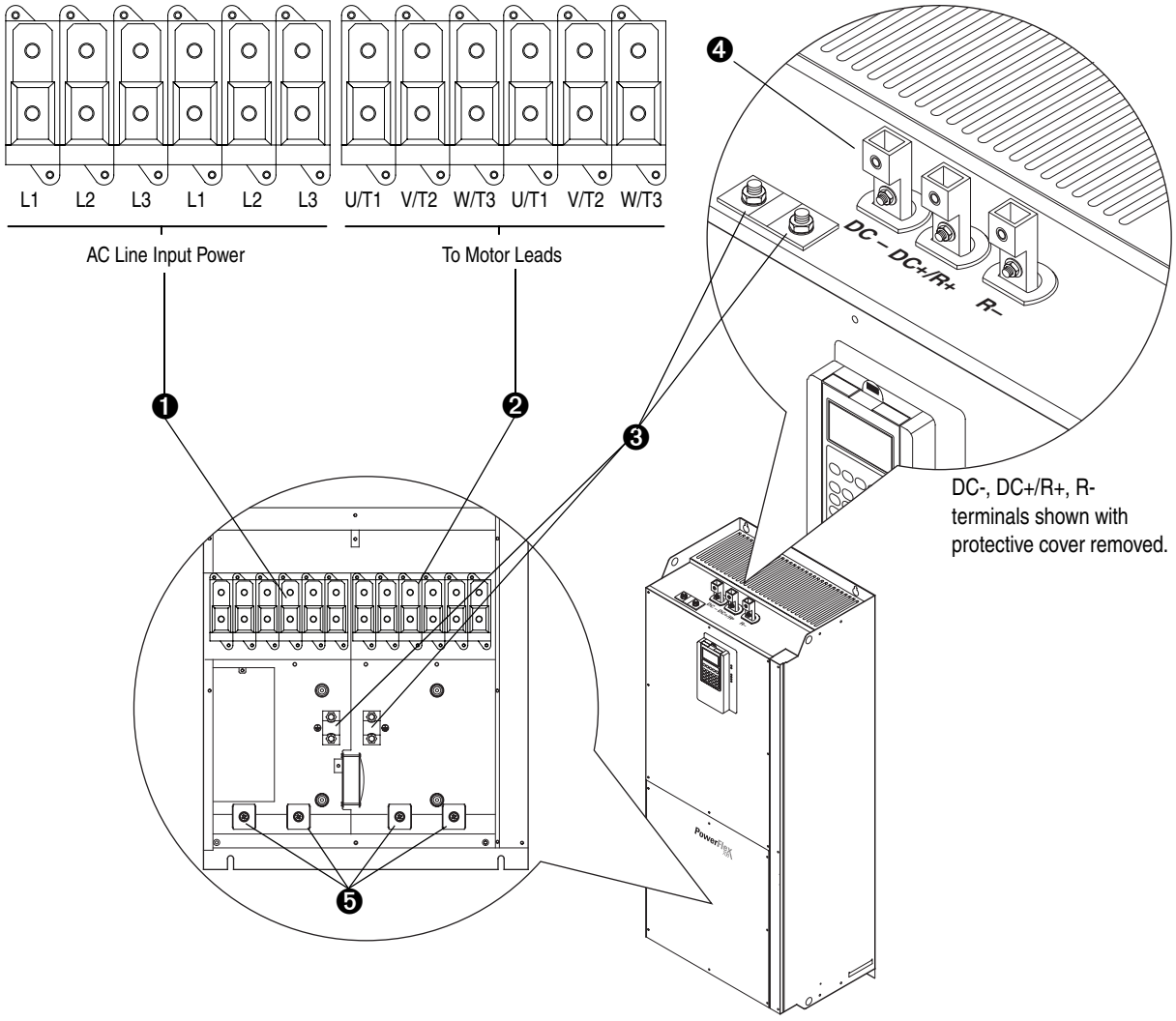
No.	Name	Description	Wire Size Range[1] Maximum	Wire Size Range[1] Minimum	Torque Recommended
❶	Input Power Terminal Block[2] L1, L2, L3	Input power	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
❷	Output Power Terminal Block[2] U/T1, V/T2, W/T3	Motor connections	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
❸	SHLD Terminal, PE, Motor Ground	Terminating point for wiring shields	95.0 mm^2 (4/0 AWG)	5.0 mm2 (10 AWG)	22 N•m (195 lb•in)
❹	DC Bus[3] (2 Terminals; DC–, DC+)	DC input or external brake resistor *(Internal Brake option not provided - Refer to Frame 9 DC Bus/Brake Connections on page 6-6.)*	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
	DC Bus w/Brake[3] (3 Terminals; DC–, DC+/R+, R–)	DC input/internal brake *(Internal Brake option is provided - Refer to Frame 9 DC Bus/Brake Connections on page 6-6.)*	185.0 mm^2 (350 MCM)	95.0 mm^2 (4/0 AWG)	40 N•m (354 lb•in)
❺	Cable Clamp for Shield				

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(2) Do Not exceed maximum wire size. Parallel connections may be required.

(3) DC terminal and brake lugs can be removed.

Figure 6.2 Terminal Locations and Power Terminal Block



Frame 9 DC Bus/Brake Connections

Figure 6.3 Connecting to DC Source Only (No Brake Option Ordered)

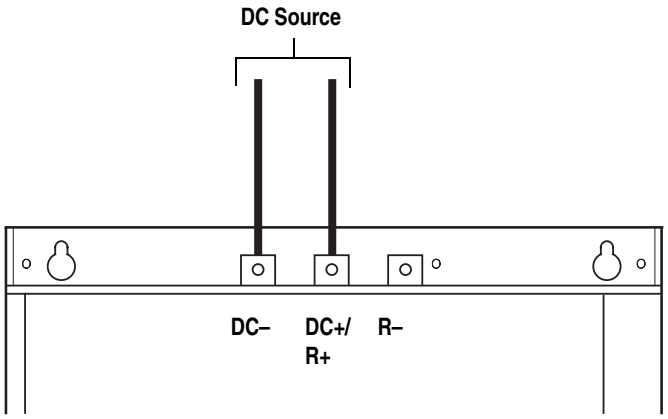


Figure 6.4 Connecting to an External Brake Resistor (Brake Option Ordered)

See Table 6.B on page 6-7 for brake resistor sizing information.

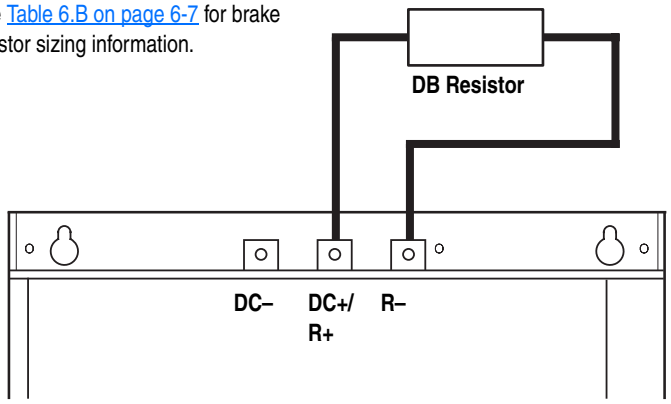


Figure 6.5 Connecting to an External Braking IGBT and Resistor (No Brake Option Ordered)

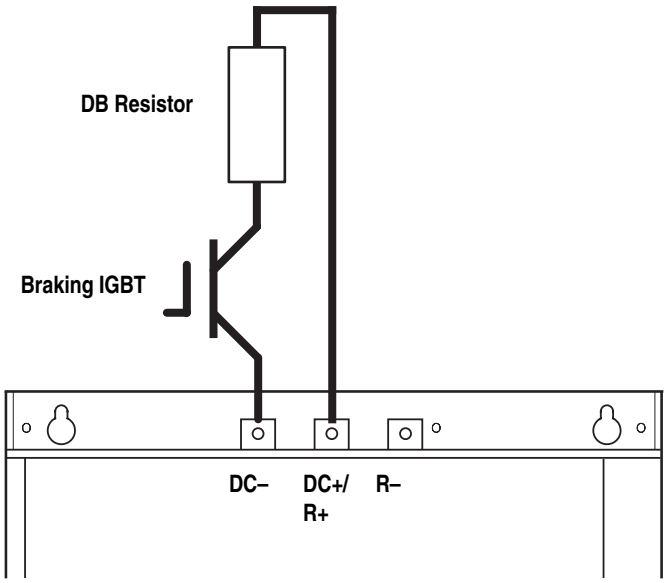
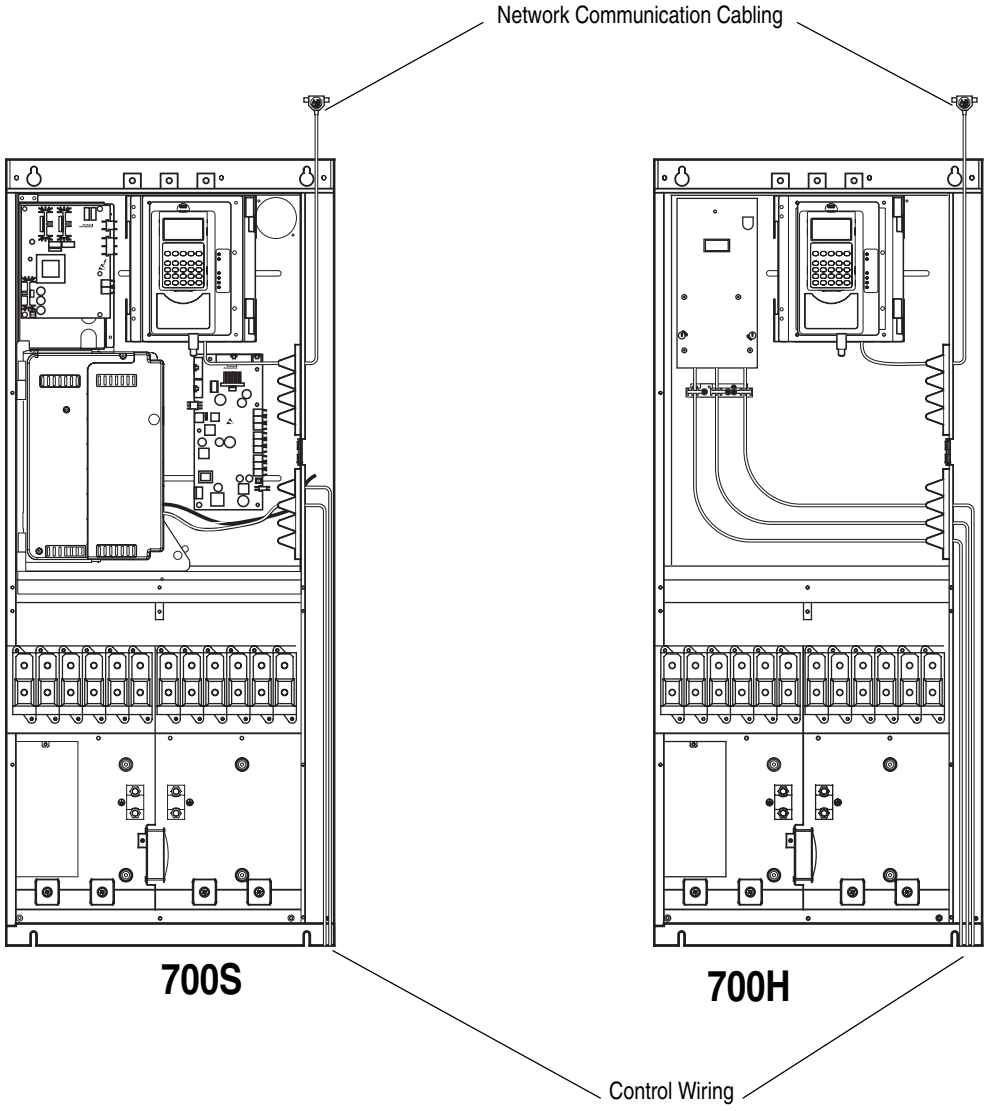


Table 6.B Frame 9 Brake Resistor Ratings

Input Voltage	Drive Catalog Number	ND Rating	Cont. Output (Amps)	Maximum Brake Current (Amps)	Resistor Nominal (Ohms)
400V AC	20DC261	132 kW	261	222	3.3
	20DC300	160 kW	300	222	3.3
480V AC	20DD261	200 HP	261	222	3.3
	20DD300	250 HP	300	222	3.3
600V AC	20DE170	150 HP	170	157.1	7
	20DE208	200 HP	208	157.1	7
690V AC	20DF170	160 kW	170	157.1	7
	20DF208	200 kW	208	157.1	7

Routing for I/O Wiring and Communication Cabling



Notes:

Frame 10 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances

Figure 7.1 Enclosure Codes: A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)

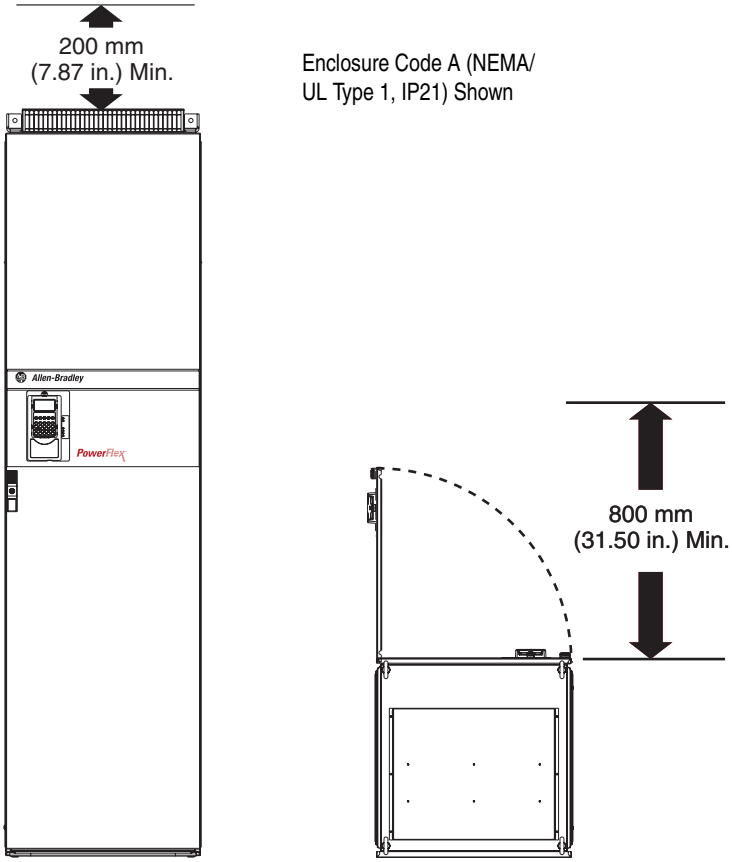
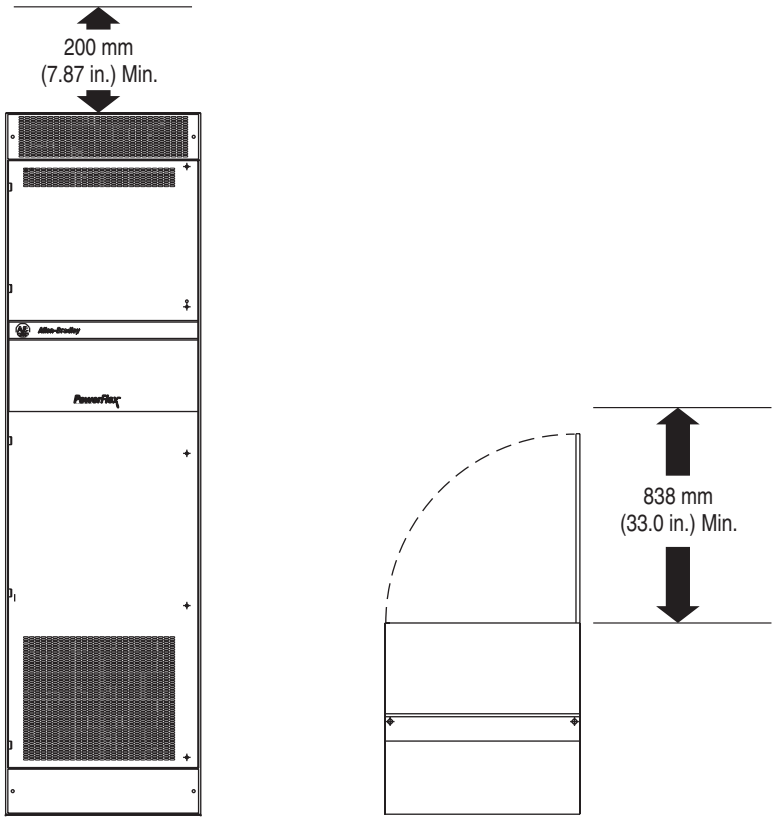


Figure 7.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Operating Temperatures

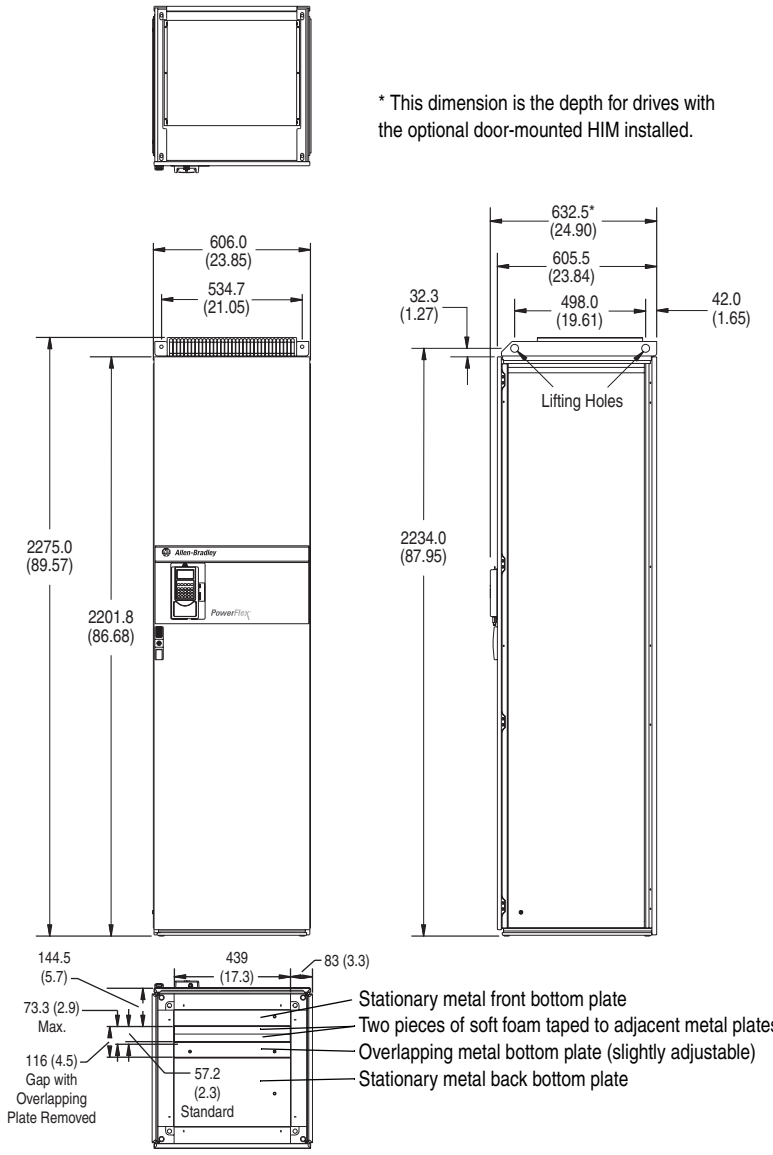
Frame 10 drives require a minimum of 2600 m^3/h (1530 cfm) of cooling air.

PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H & 700S	400/480V AC (540/650V DC)	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	261, 325, 385	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	416	0 to 35° C (32 to 95° F)	0 to 40° C (32 to 104° F)

Dimensions

Figure 7.3 Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Figure 7.4 Enclosure Code B (NEMA/UL Type 1, IP20 MCC) and K (NEMA/UL Type 1, IP20 MCC w/Conformal Coat)

Dimensions are in millimeters and (inches).

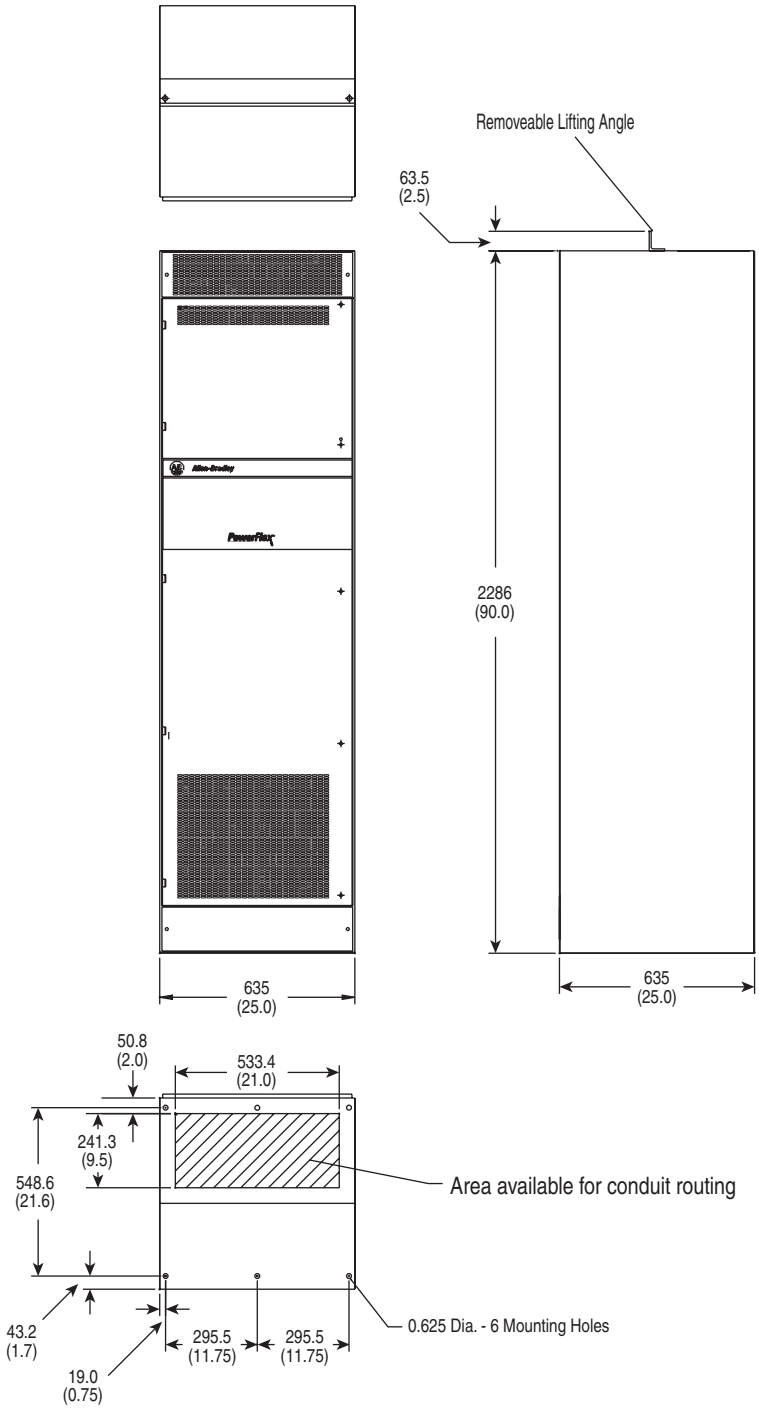
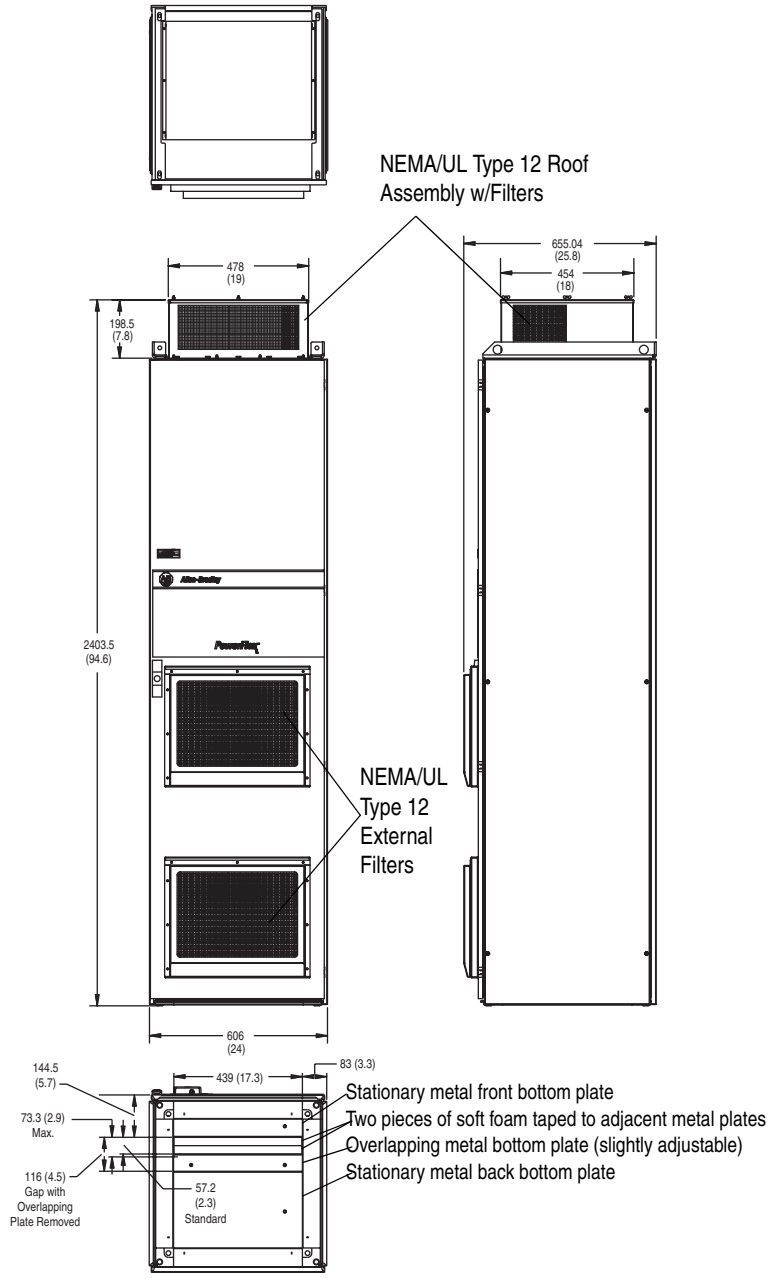


Figure 7.5 Enclosure Code H (NEMA/UL Type 12 - IP54) and W (NEMA/UL Type 12 - IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Lifting and Mounting Frame 10 Drives

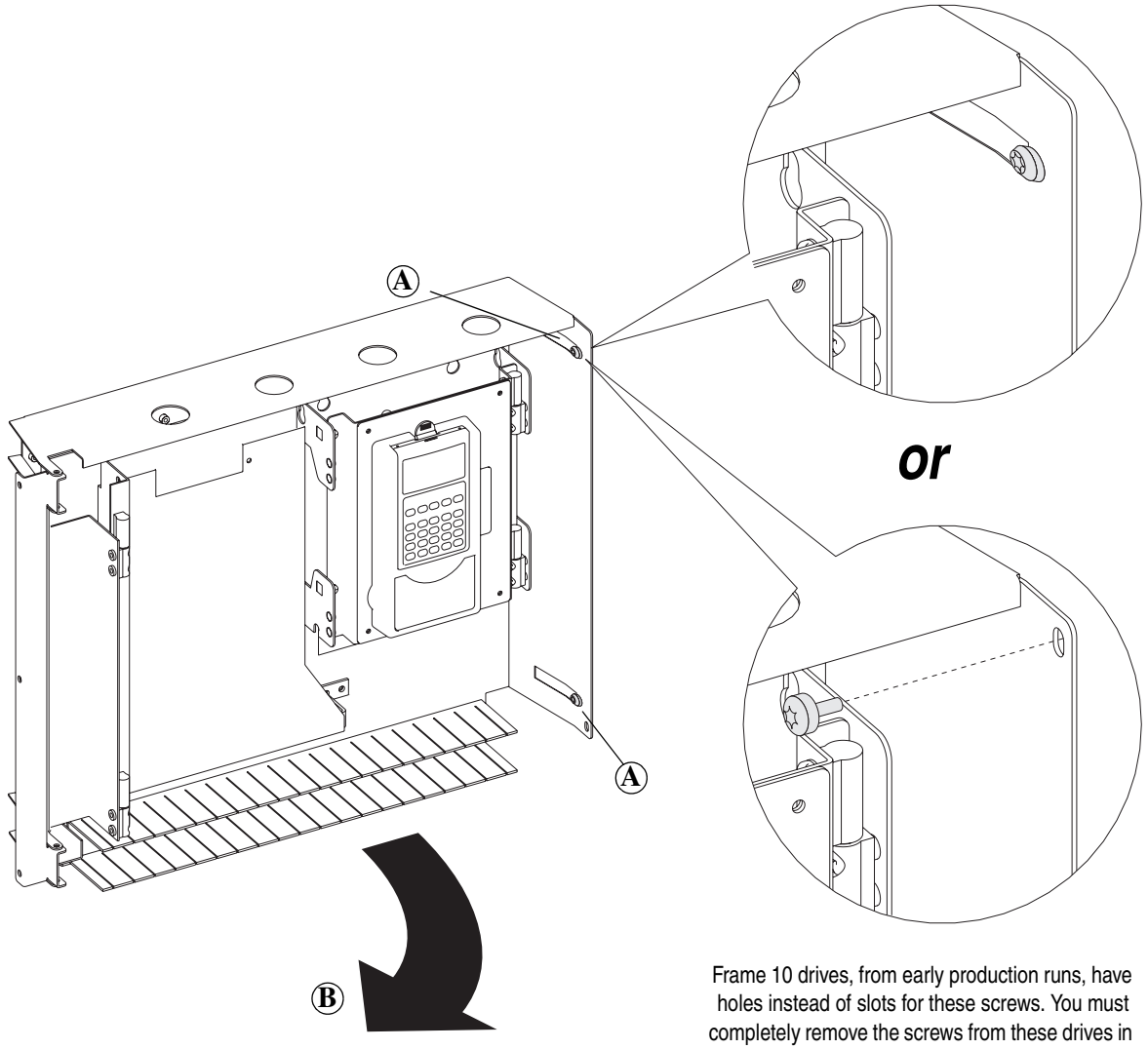
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

Removing the Protective Covers

Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 7-7.

Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure (Remove screws on early frame 10 drives).
Ⓑ	Swing the Control Frame out and away from the power structure.

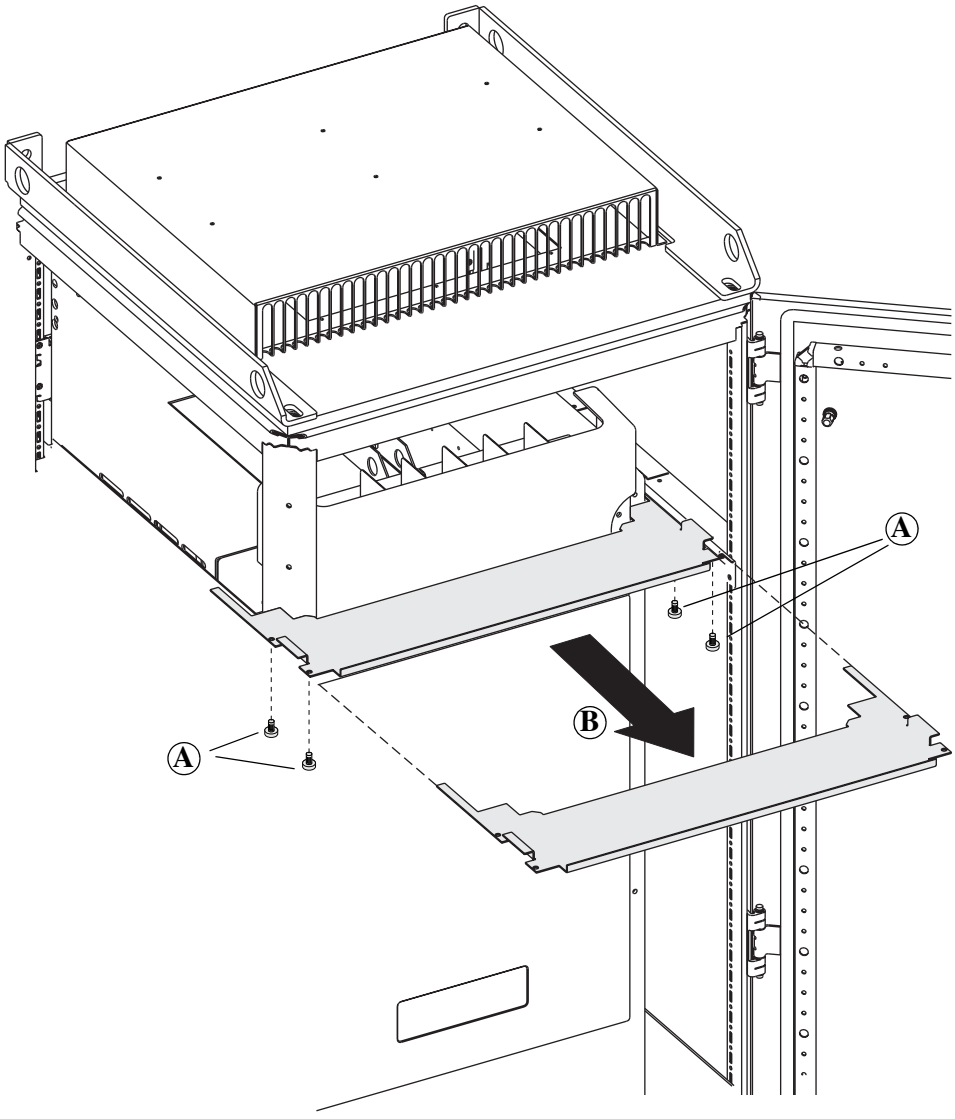


Frame 10 drives, from early production runs, have holes instead of slots for these screws. You must completely remove the screws from these drives in order to swing-open the control frame.

Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 7-8.

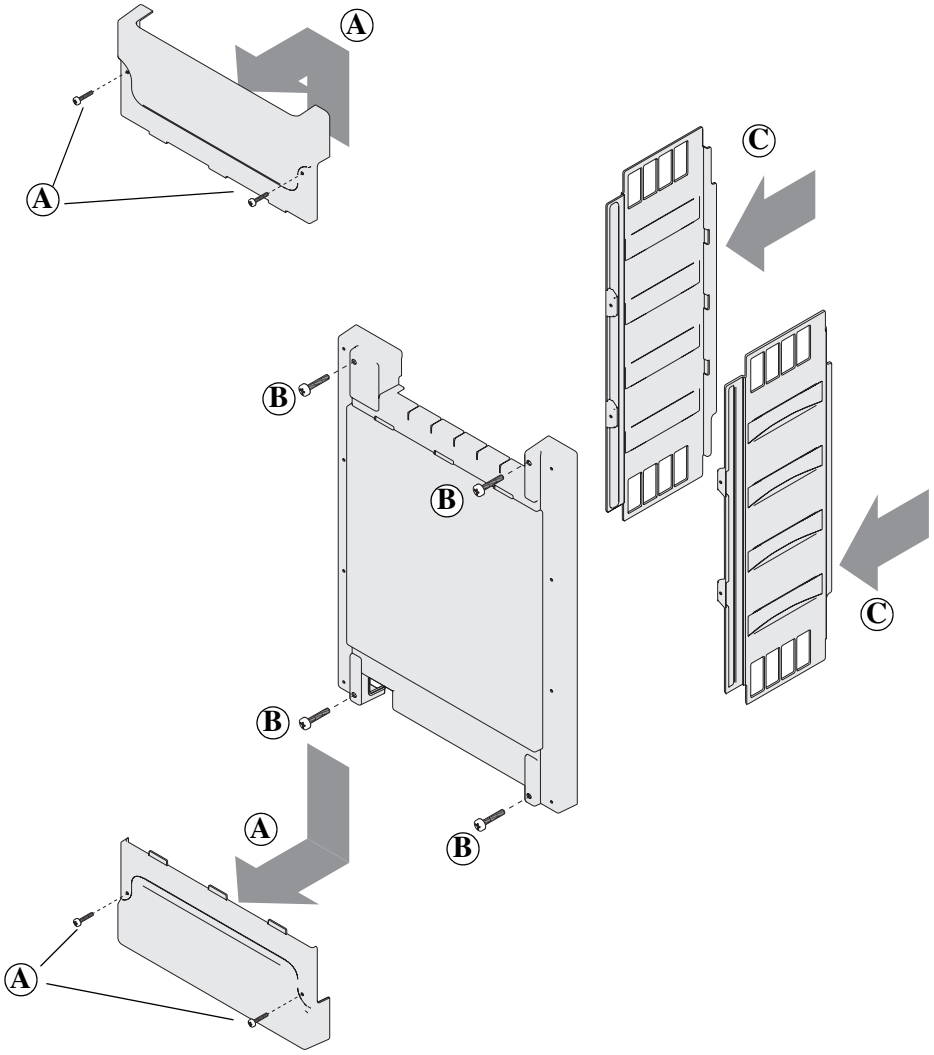
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Removing the Protective Covers

You must remove the protective covers to gain access to the power structure.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers. ***Note:*** *you only need to remove the top and bottom covers to gain access to the power terminals. You can remove the other covers without removing the top and bottom ones.*
Ⓑ	Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover.
Ⓒ	Remove the side protective covers.



Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 10 size drives are equipped with common mode capacitors and capacitors that are connected to the input terminals. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

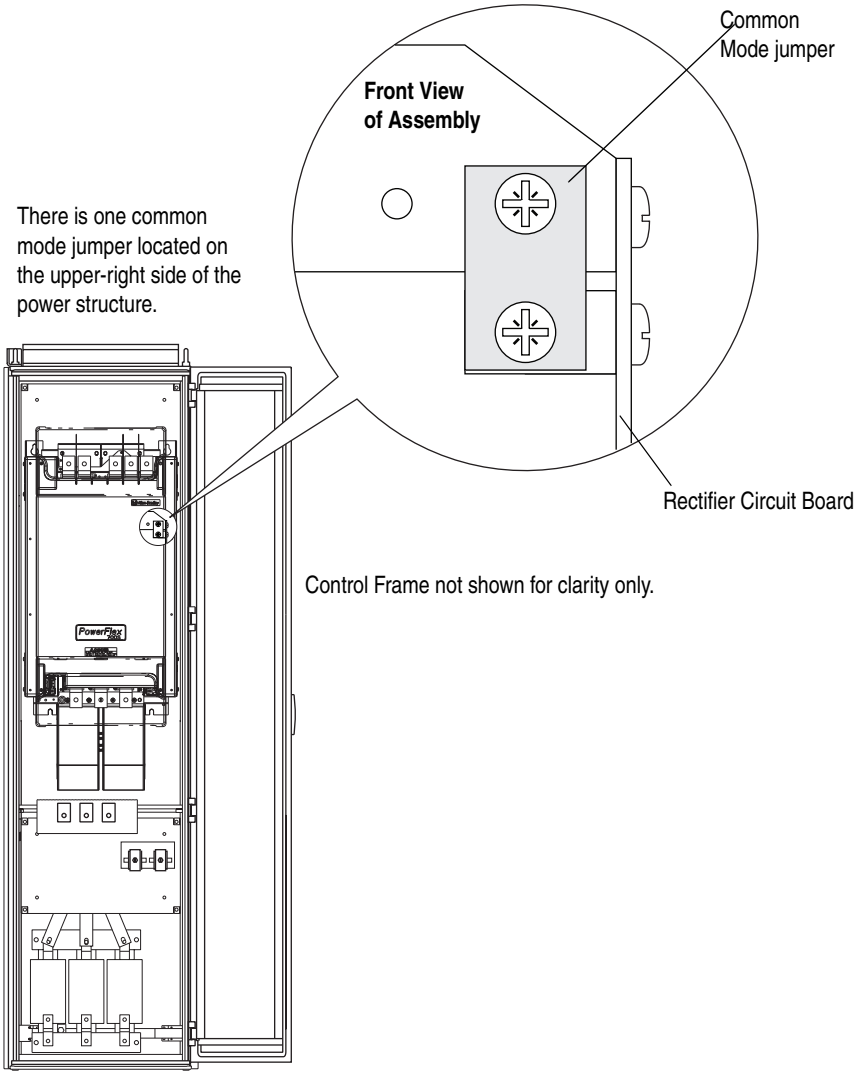
Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 7-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 7-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 7-13.

Note: Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

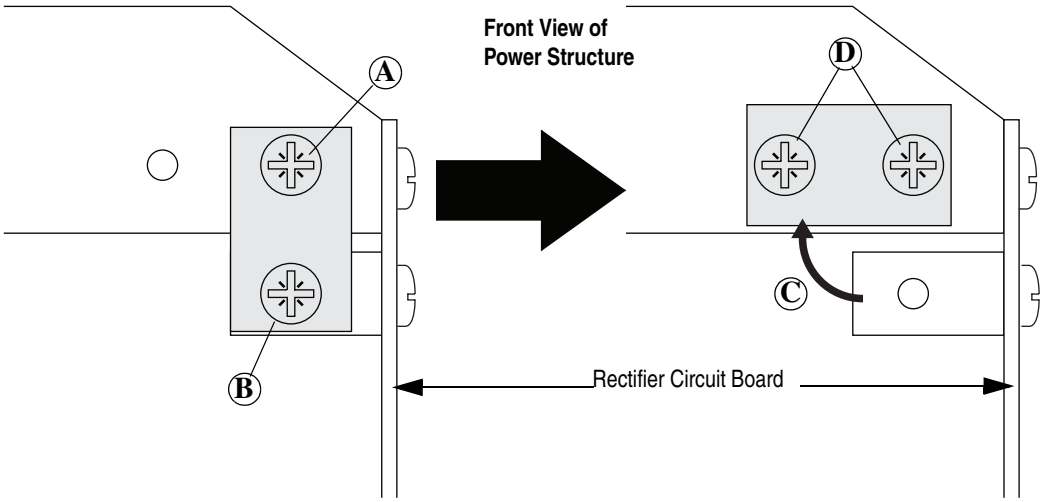
Figure 7.6 Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 7.6 for jumper location):

Task	Description
Ⓐ	Loosen the upper screw.
Ⓑ	Remove the lower screw.
Ⓒ	Move the jumper to the horizontal position.
Ⓓ	Install and tighten the screws.

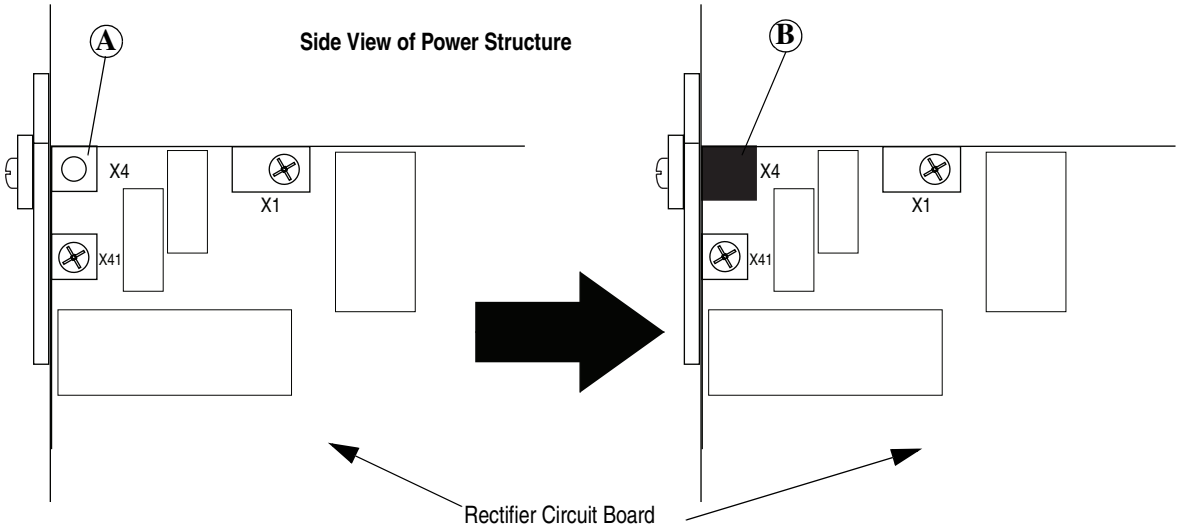


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 7.6 for Rectifier board location):

Task	Description
Ⓐ	Remove the screw from the X4 connection on the Rectifier circuit board.
Ⓑ	Insulate the top and bottom of the X4 connection on the Rectifier circuit board.

Important: Do not install the screw and washer that was removed from this connection.



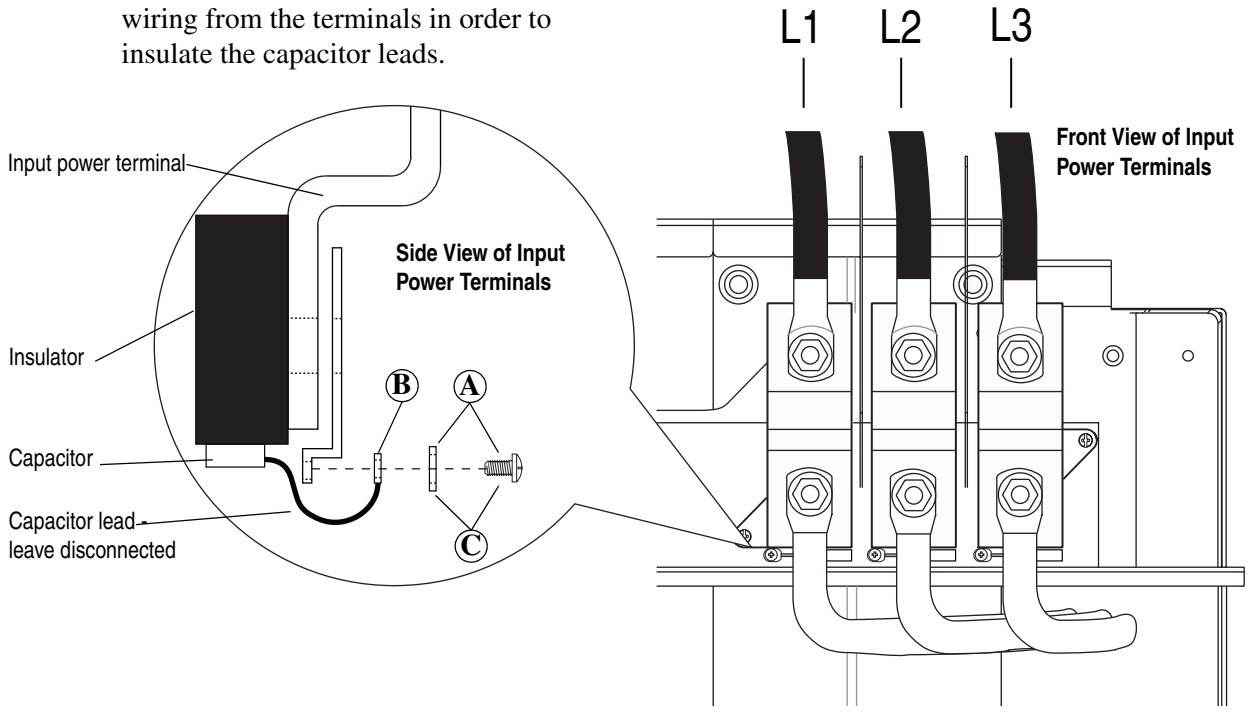
Disconnect the Small Capacitors from the Input Terminals

Follow the lettered steps below to disconnect the small capacitors from the input terminals:

Task	Description
Ⓐ	Remove the screws and lock washers that secure each of the three capacitor supply wires to the input power terminals.
Ⓑ	Insulate the capacitor leads and leave disconnected.
Ⓒ	Install and tighten the screws and lock washers only.

Important: Do not re-install the capacitor leads.

Important: It is not necessary to remove the power wiring from the terminals in order to insulate the capacitor leads.



Power Wiring

Important: Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 7-6.)

Table 7.A Power Terminal Specifications

No.	Name	Description	Wire Size Range[1][2]		Torque	Terminal Bolt Size [3][4]
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block [3] L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❷	Output Power Terminal Block[3] U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❸	SHLD Terminal, PE, Motor Ground [3]	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M10
❹	DC Bus [3] (2 Terminals; DC–, DC+)	DC input or external brake	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❺	Cable Clamp for Shield					

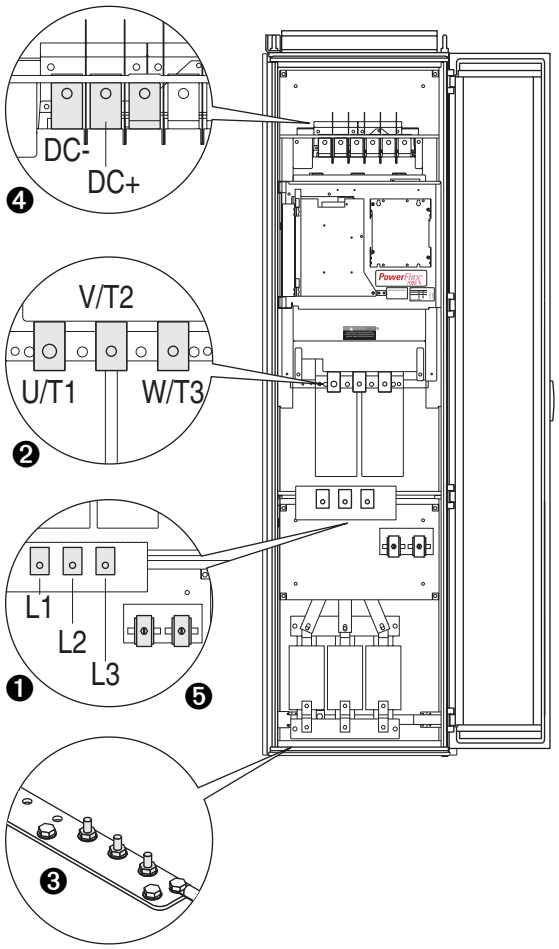
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(2) Do Not exceed maximum wire size. Parallel connections may be required.

(3) These connections are bus bar type terminations and require the use of lug type connectors.

(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.

Figure 7.7 Terminal Locations



Frame 11 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances

Figure 8.1 Enclosure Codes: A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)

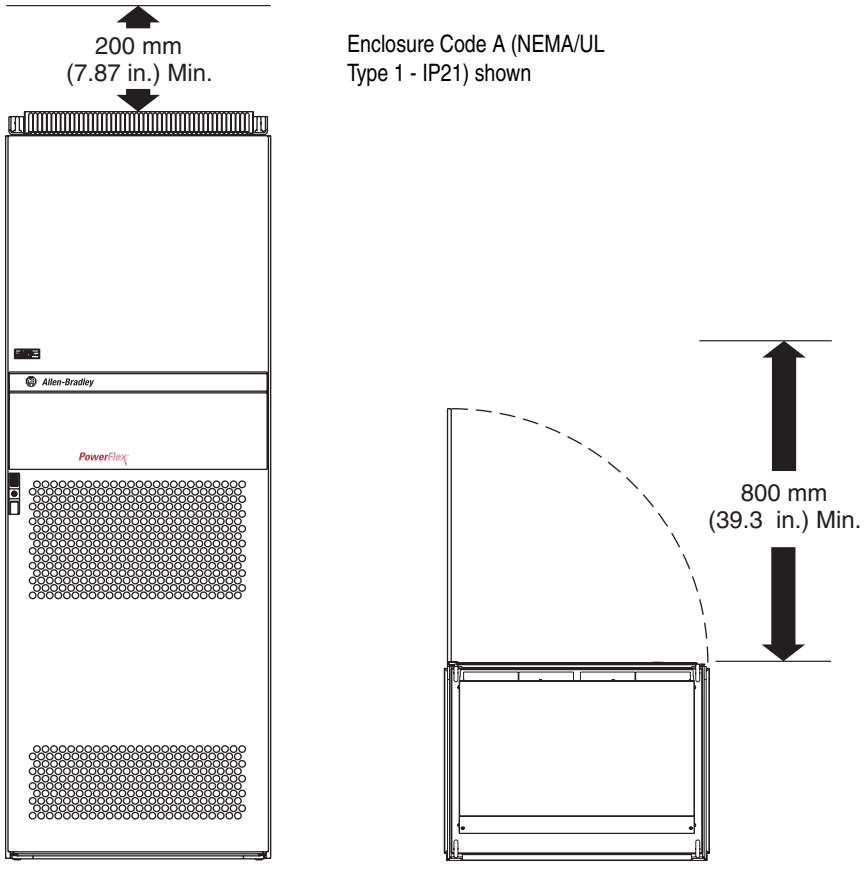
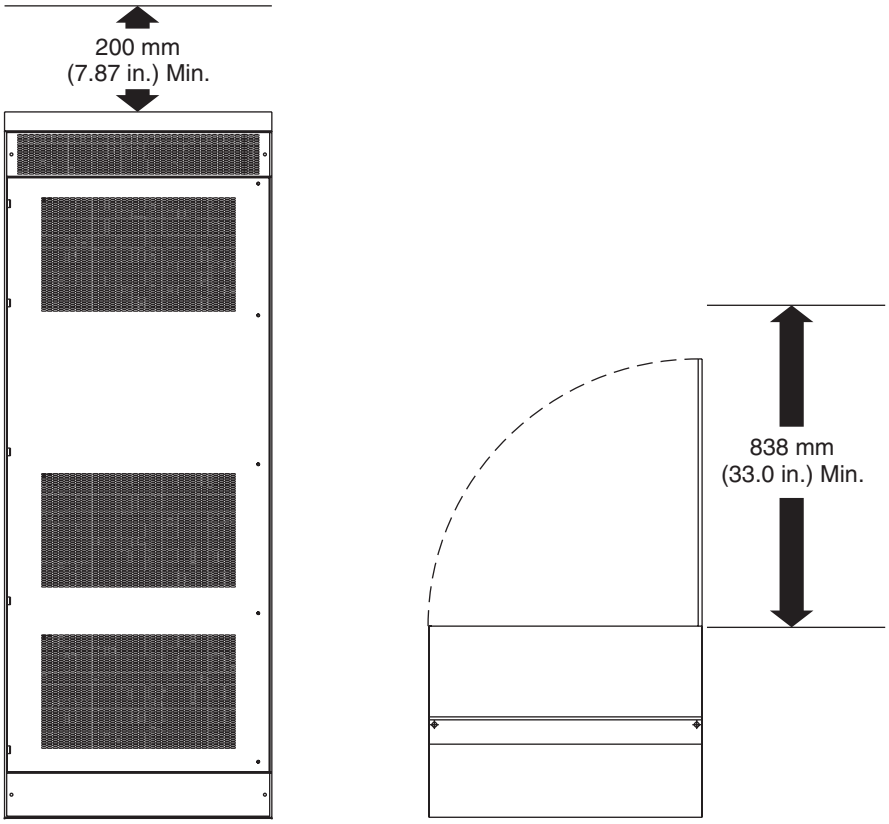


Figure 8.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Operating Temperatures

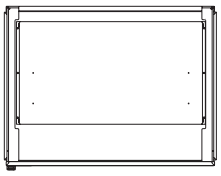
Frame 11 drives require a minimum of 3900 m^3/h (2295 cfm) of cooling air.

PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H	All	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
700S	400/480V AC (540/650V DC)	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	460, 502	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	590	0 to 35° C (32 to 95° F)	0 to 35° C (32 to 95° F)

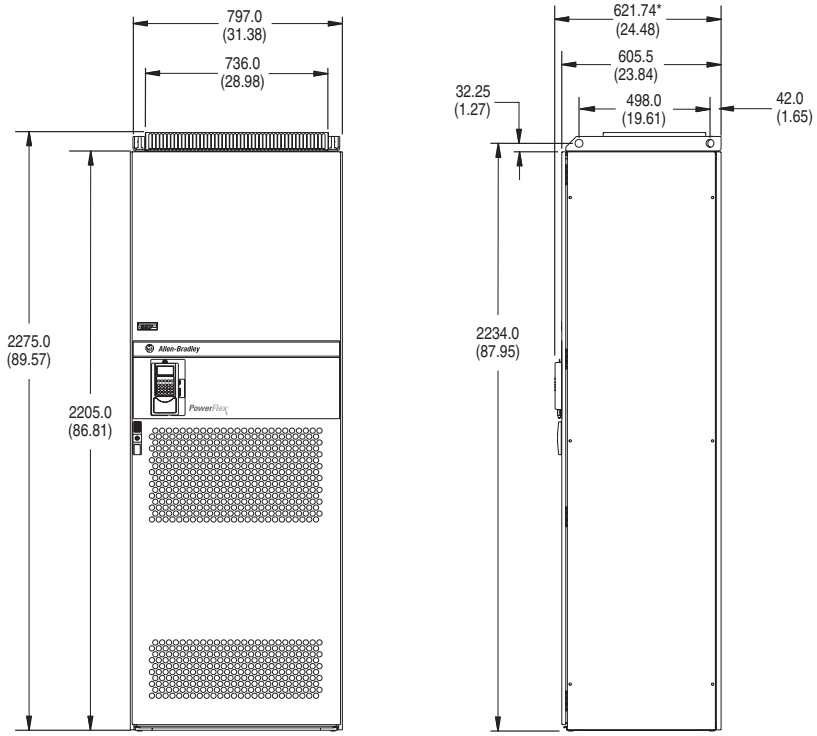
Dimensions

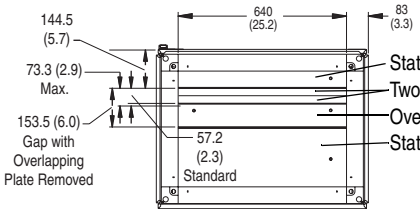
Figure 8.3 Enclosure Code A NEMA/UL Type 1 - IP21 and M (NEMA/UL Type 1, IP21 w/ Conformal Coat)

Dimensions are in millimeters and (inches).



* This dimension is the depth for drives with the optional door-mounted HIM installed.





Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Figure 8.4 Enclosure Code B (NEMA/UL Type 1, IP20 MCC) and K (NEMA/UL Type 1, IP20 MCC w/Conformal Coat)

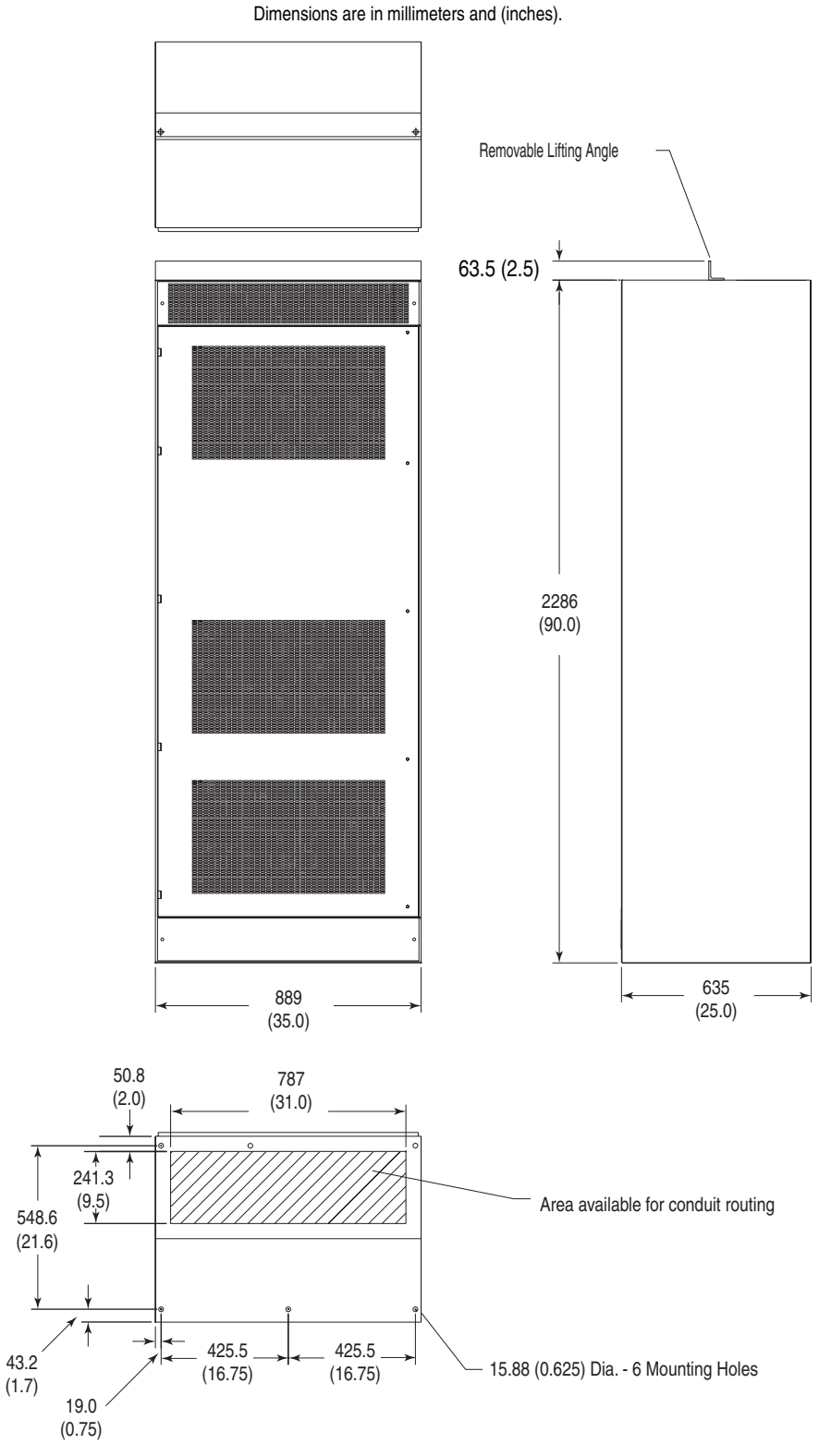
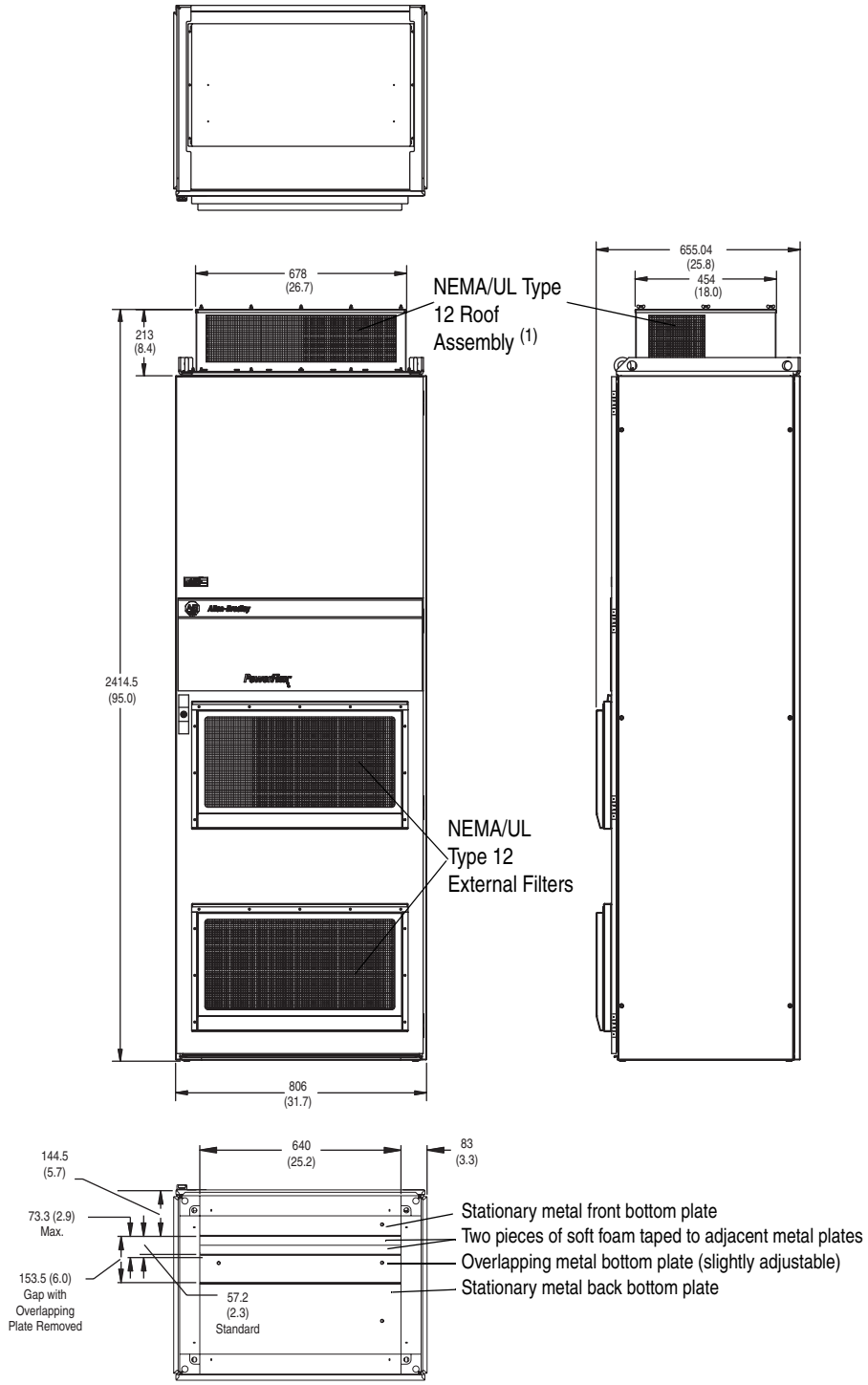


Figure 8.5 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12 - IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

(1) NEMA/UL Type 12/IP54 Roof Assembly is 242 mm (9.5 in.) for Frame 11, 400V 730A and 600V, 590A drives. For these drives, the total height of the drive is 2443.5 mm (104.5 in.).

Lifting and Mounting Frame 11 Drives

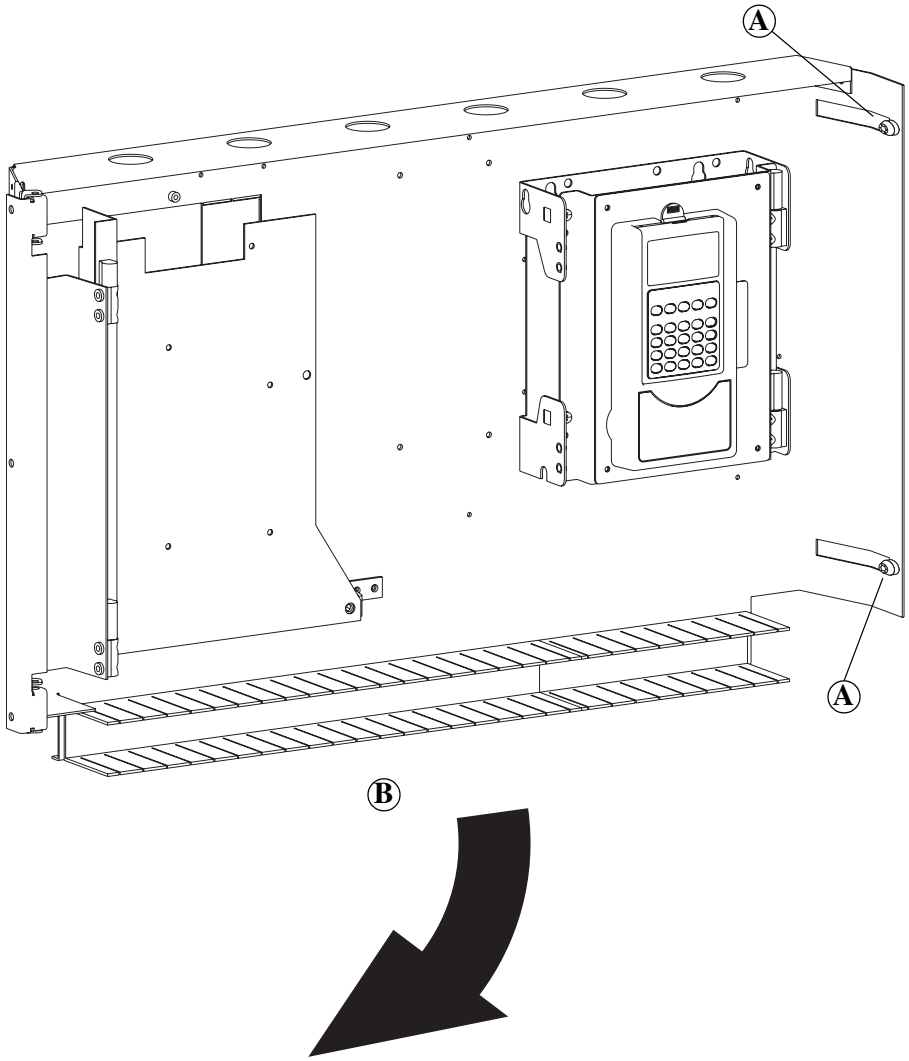
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directedd below.

Removing the Protective Covers

Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 8-7.

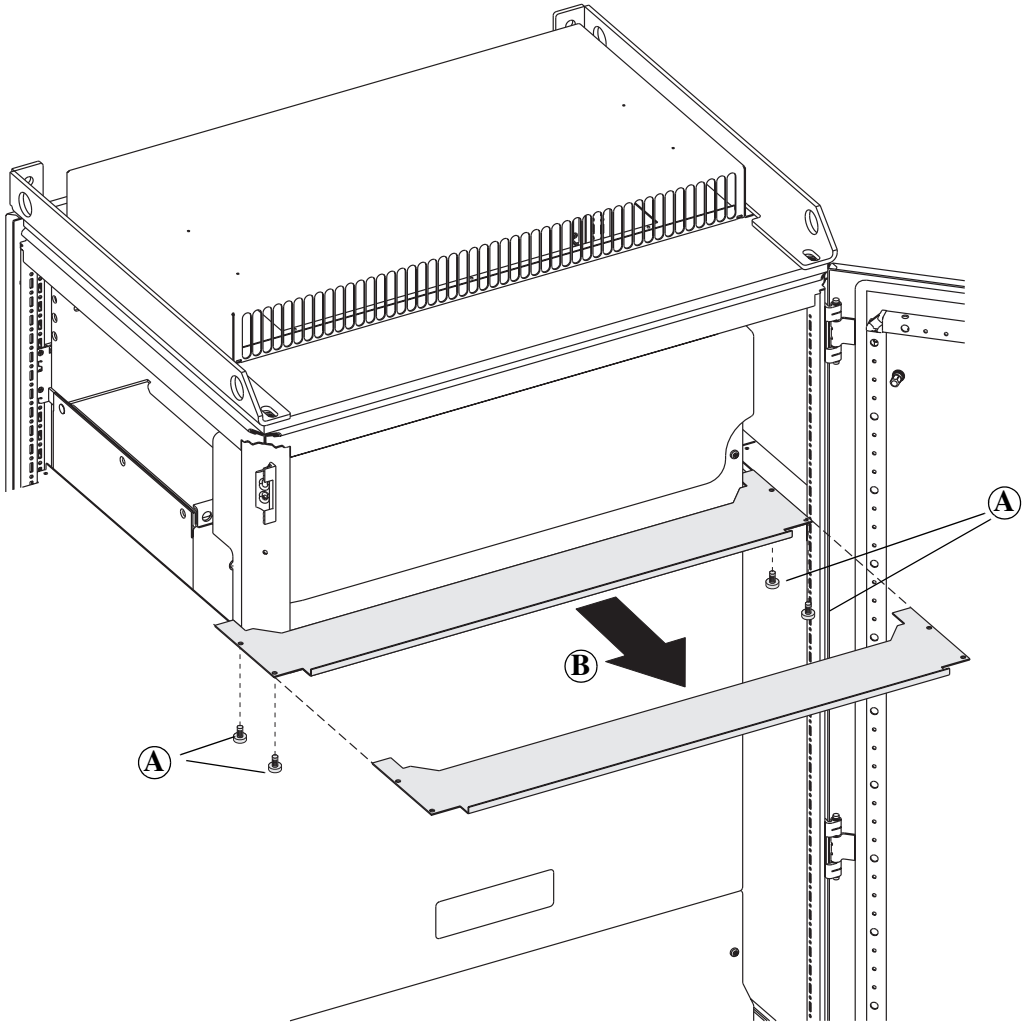
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure.
Ⓑ	Swing the Control Frame out and away from the power structure.



Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 8-8.

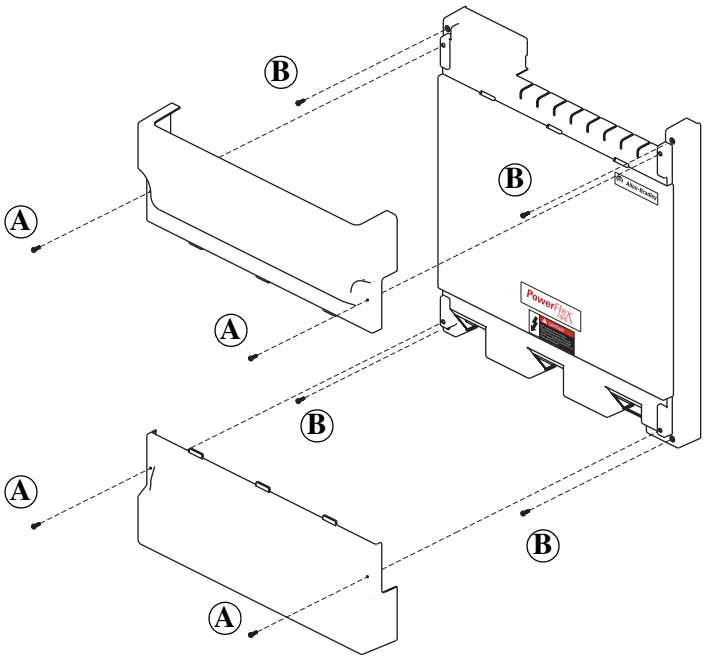
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Removing the Protective Covers

You must remove the protective covers to gain access to the power terminals.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers.
Ⓑ	Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover.



Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 11 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

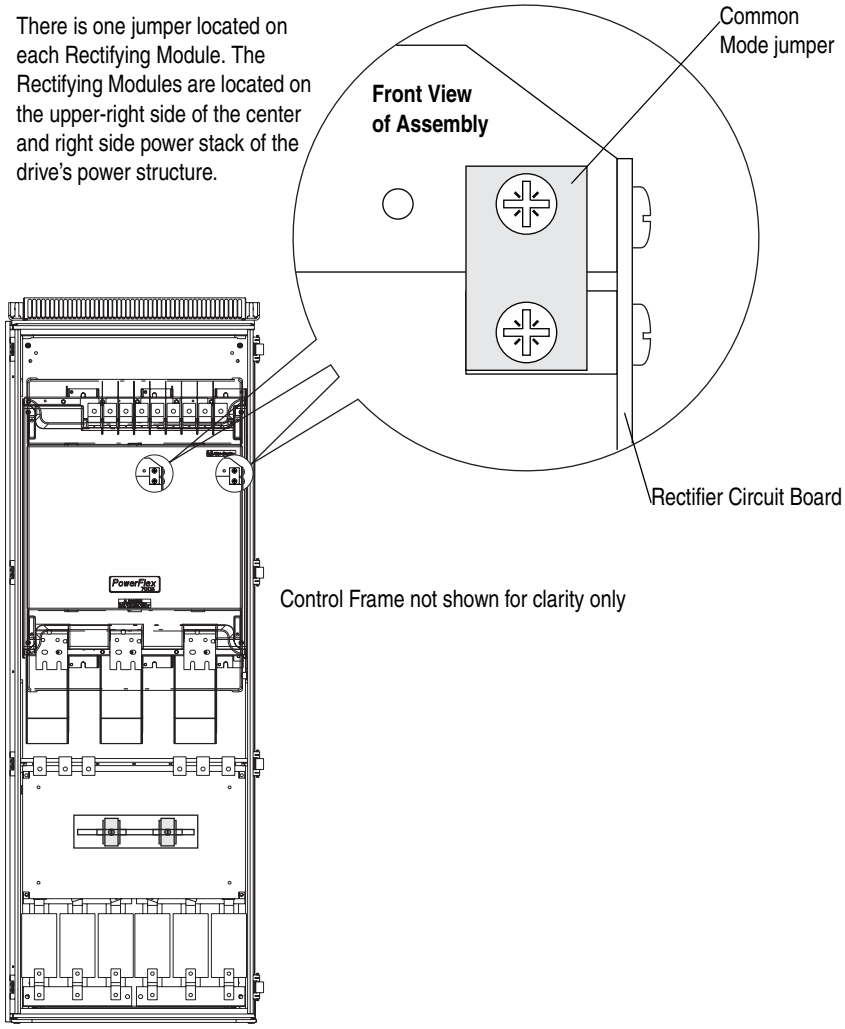
Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 8-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 8-12.

Note: Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

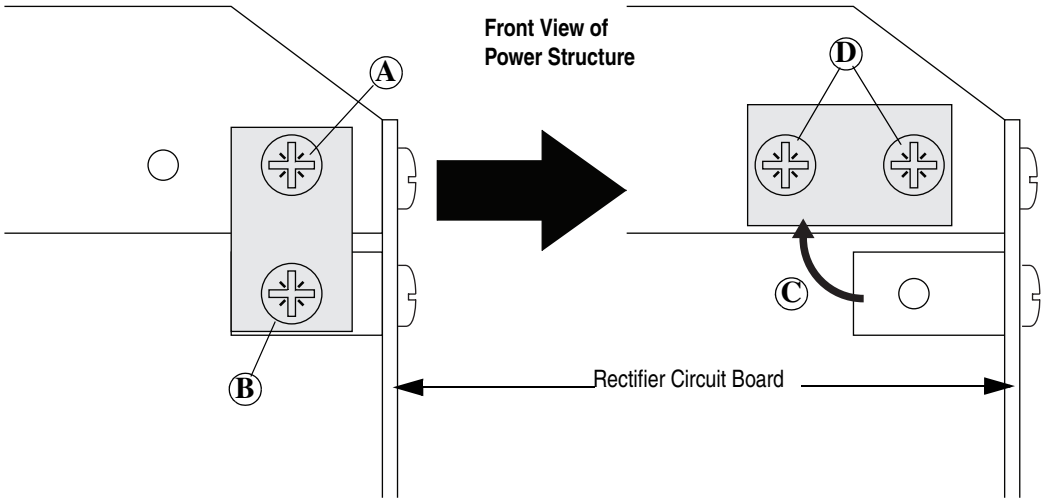
Figure 8.6 Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 8.6 for jumper location):

Task	Description
Ⓐ	Loosen the upper screw.
Ⓑ	Remove the lower screw.
Ⓒ	Move the jumper to the horizontal position.
Ⓓ	Install and tighten the screws.

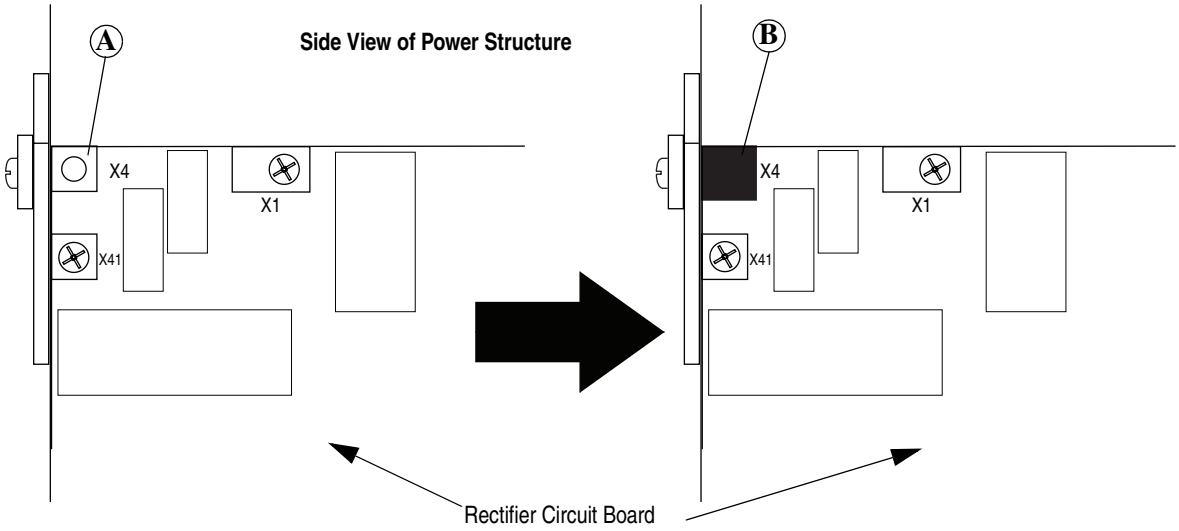


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 8.6 for Rectifier board location):

Task	Description
Ⓐ	Remove the screw from the X4 connection on the Rectifier circuit board.
Ⓑ	Insulate the top and bottom of the X4 connection on the Rectifier circuit board.

Important: Do not install the screw and washer that was removed from this connection.



Power Wiring

AC Input Wiring

The table below identifies which frame 11 drives contain only one rectifying module and which frame 11 drives contain two rectifying modules. Drives with one rectifying module contain only one set of input power terminals. Drives with two parallel rectifying modules contain two sets of input power terminals--you must supply power to both sets of input terminals on these drives. There are several methods for accomplishing this. Each of these methods is shown below.

Voltage Class	Amps	Number of Rectifiers
400/480V AC Input	590	2
	650	2
	730	2
600/690V AC Input	460	1
	502	1
	590	2

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Figure 8.1 AC Wiring Example: Two Fuses per Phase

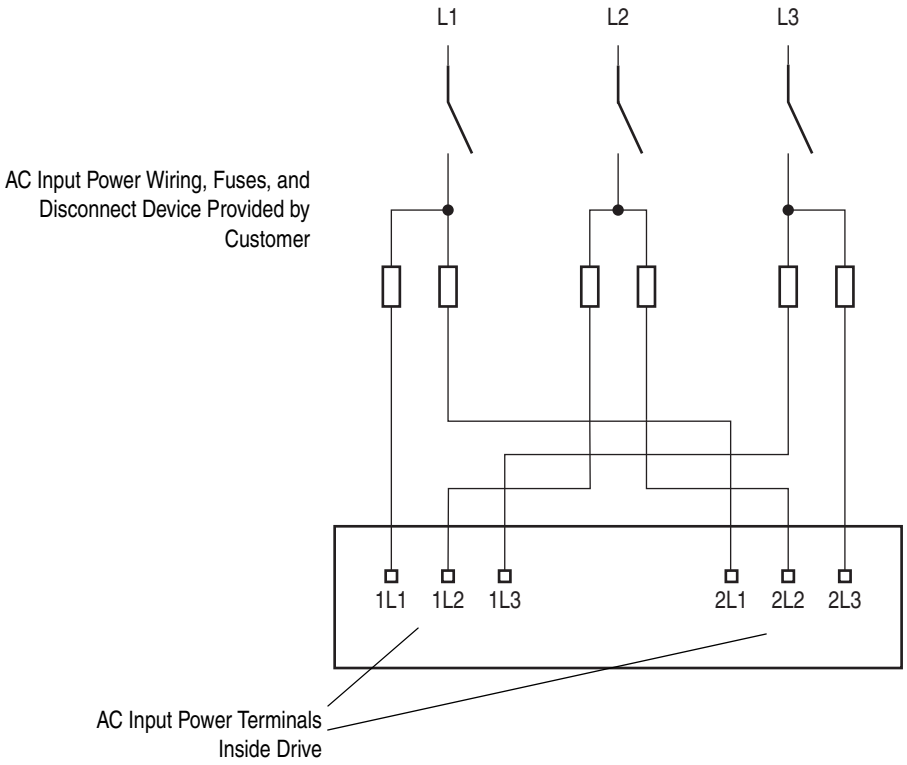


Figure 8.2 AC Wiring Example: One Fuse per Phase

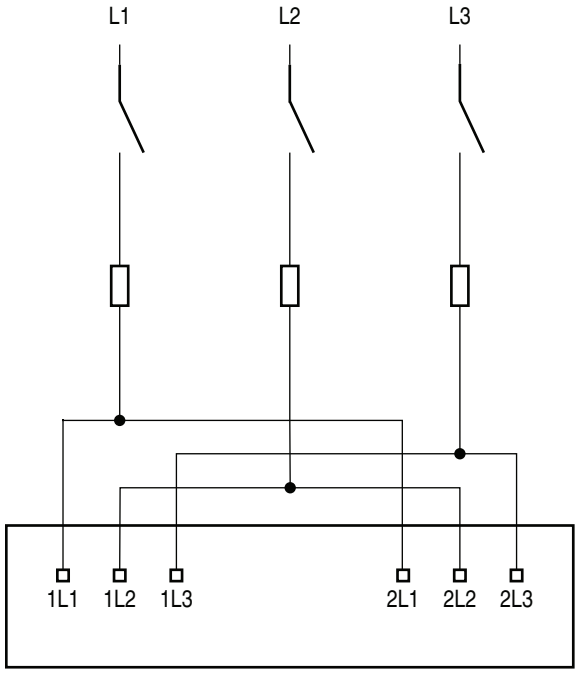
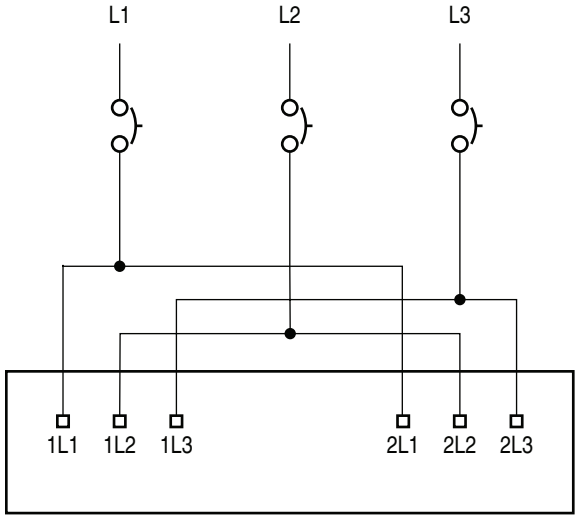


Figure 8.3 AC Wiring Example: Circuit Breaker



Important: Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 8-6.)

Table 8.A Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block (3) 1L1, 1L2, 1L3, 2L1, 2L2, 2L3	AC Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❷	Output Power Terminal Block (3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❸	SHLD Terminal, PE, Motor Ground (3)	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M10
❹	DC Bus (3) (2 Terminals; DC–, DC+)	DC input or external brake	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❺	Cable Clamp for Shield					

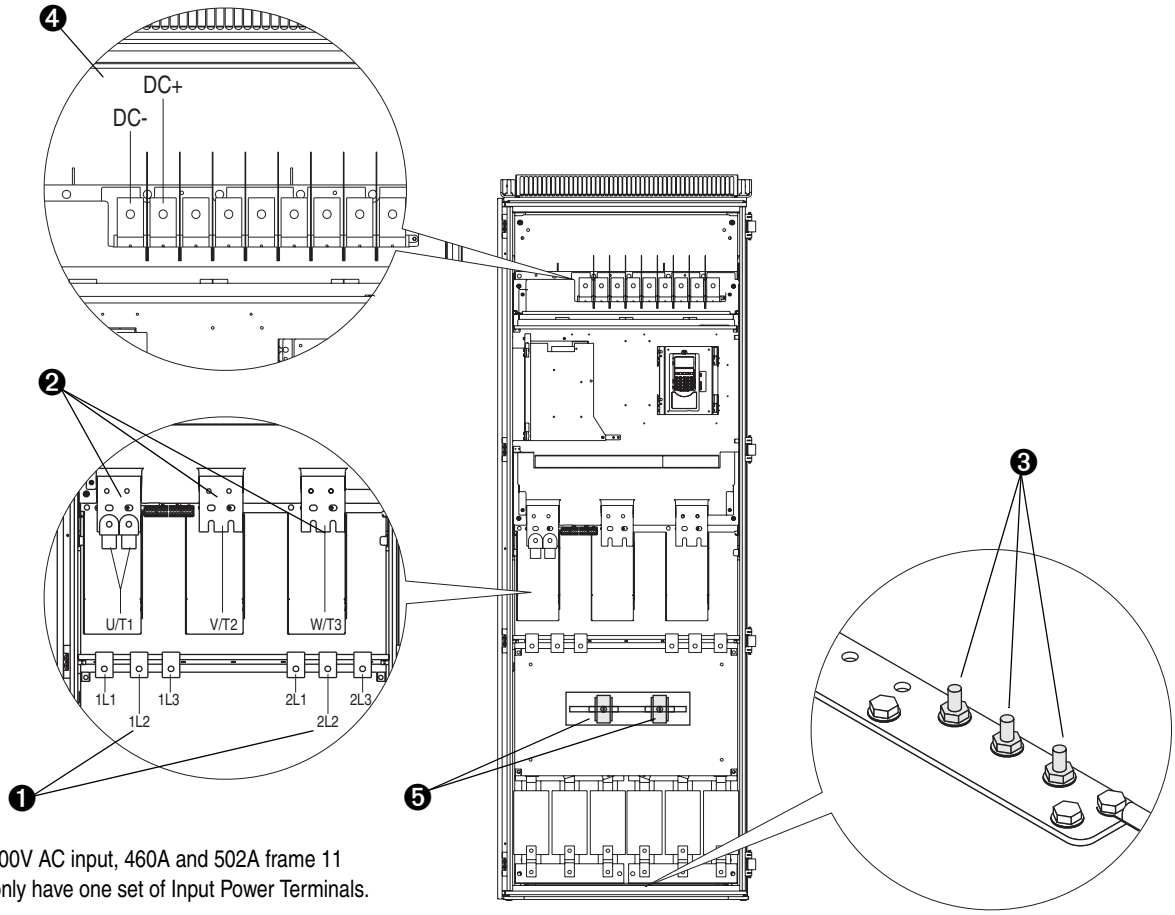
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(2) Do Not exceed maximum wire size. Parallel connections may be required.

(3) These connections are bus bar type terminations and require the use of lug type connectors.

(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.

Figure 8.7 Terminal Locations



Note: 600V AC input, 460A and 502A frame 11 drives only have one set of Input Power Terminals.

Notes:

Frame 12 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances

Figure 9.1 Enclosure Codes A (NEMA/UL Type 1, IP21), M (NEMA/UL Type 1, IP21 w/ Conformal Coat), H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/ Conformal Coat)

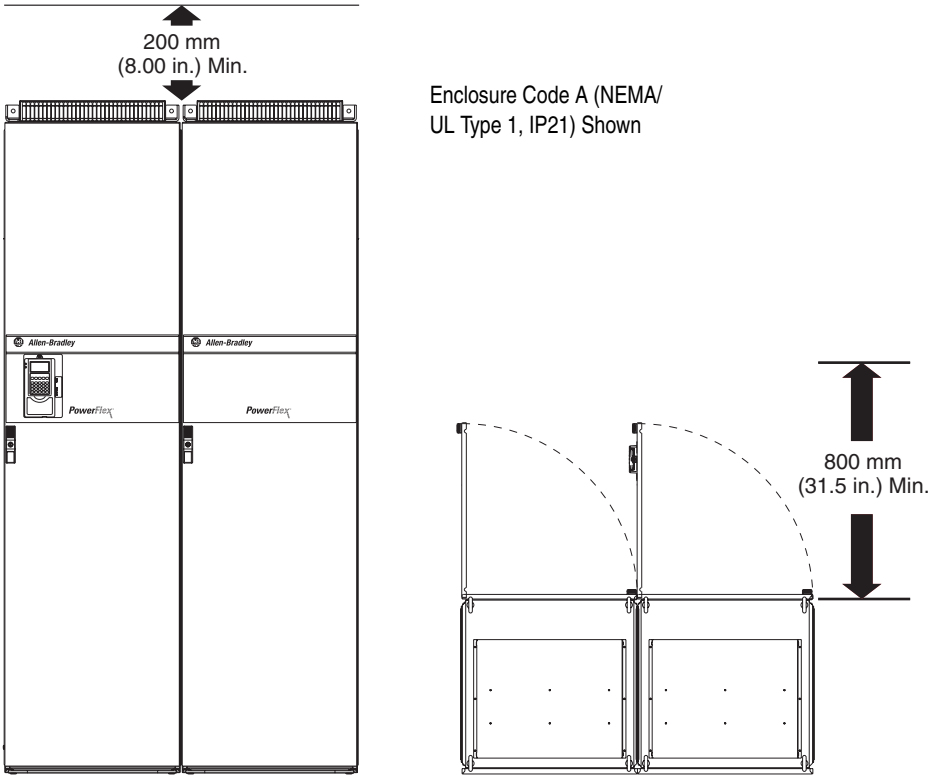
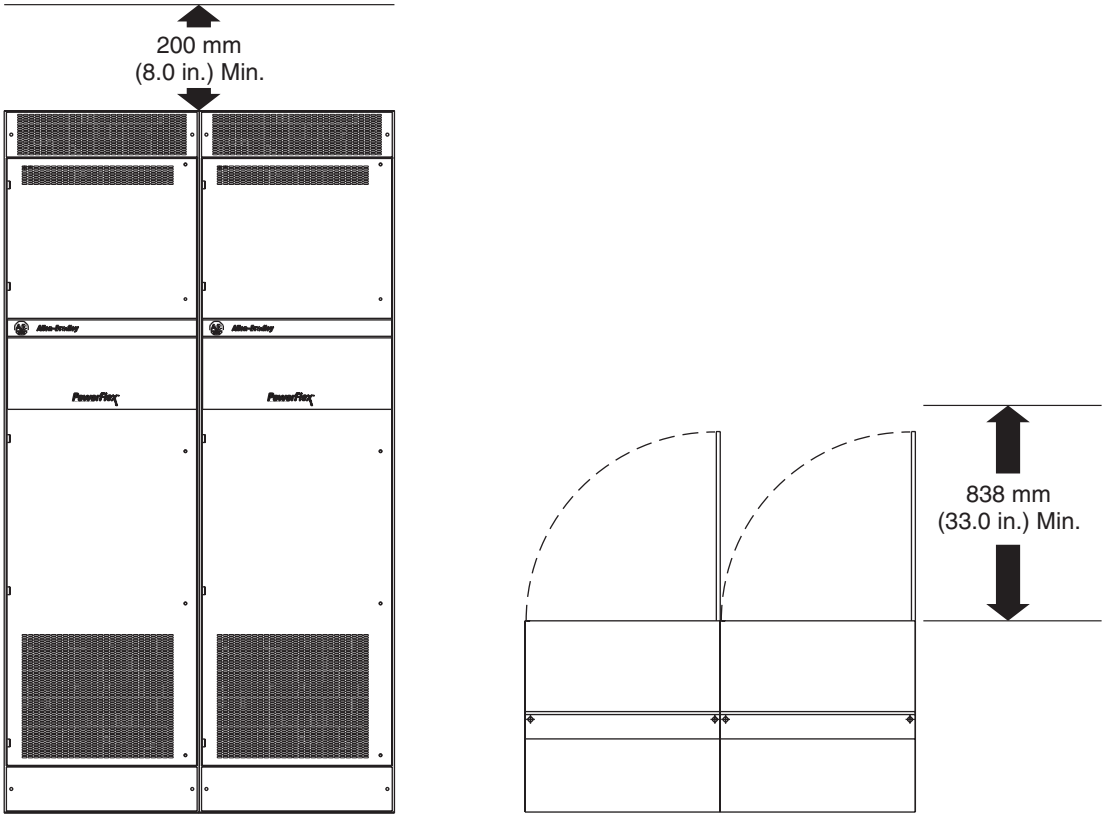


Figure 9.2 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Operating Temperatures

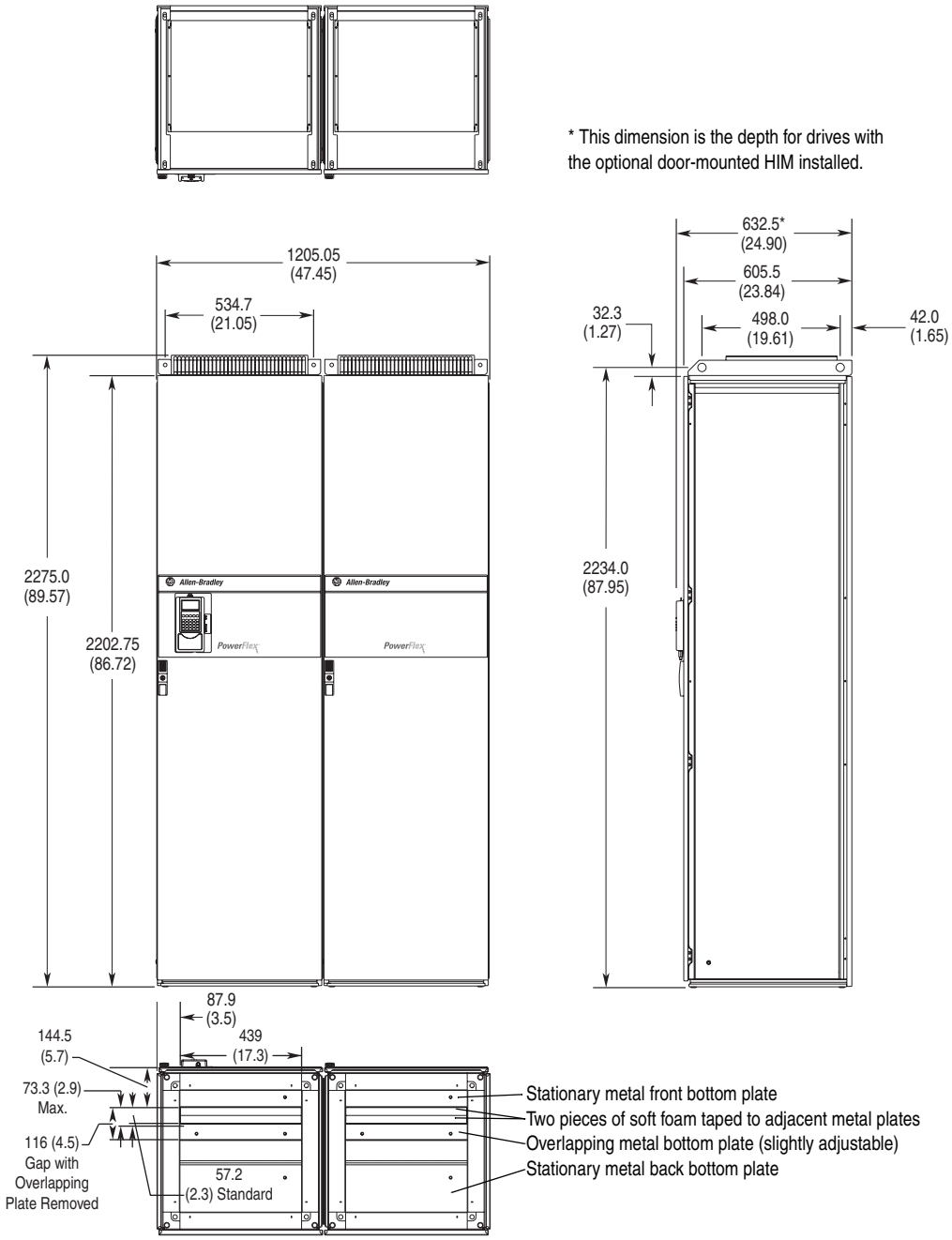
Frame 12 drives require a minimum of 5200 m^3/h (3060 cfm) of cooling air.

PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H	400/480V AC (540/650V DC)	820, 920	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	400/480V AC (540/650V DC)	1030	0 to 40° C (32 to 104° F)	0 to 35° C (32 to 95° F)
	600/690V AC (810/932V DC)	820, 920	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	1030	0 to 35° C (32 to 95° F)	0 to 40° C (32 to 104° F)
700S	400/480V AC (540/650V DC)	820, 920	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	400/480V AC (540/650V DC)	1030	0 to 40° C (32 to 104° F)	0 to 35° C (32 to 95° F)
	600/690V AC (810/932V DC)	820, 920	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	1030	0 to 35° C (32 to 95° F)	0 to 35° C (32 to 95° F)

Dimensions

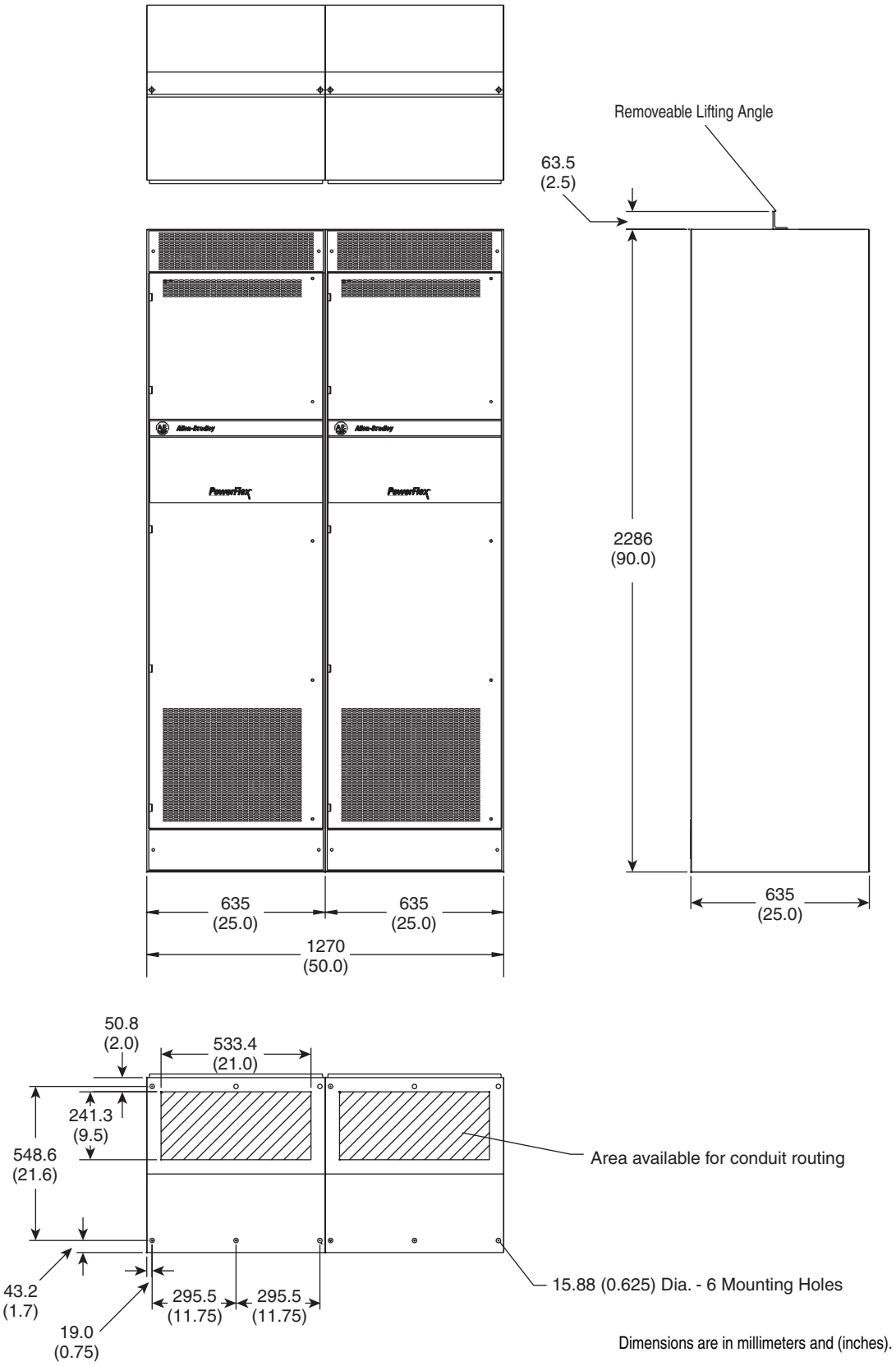
Figure 9.3 Enclosure Code A (NEMA/UL Type 1 - IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

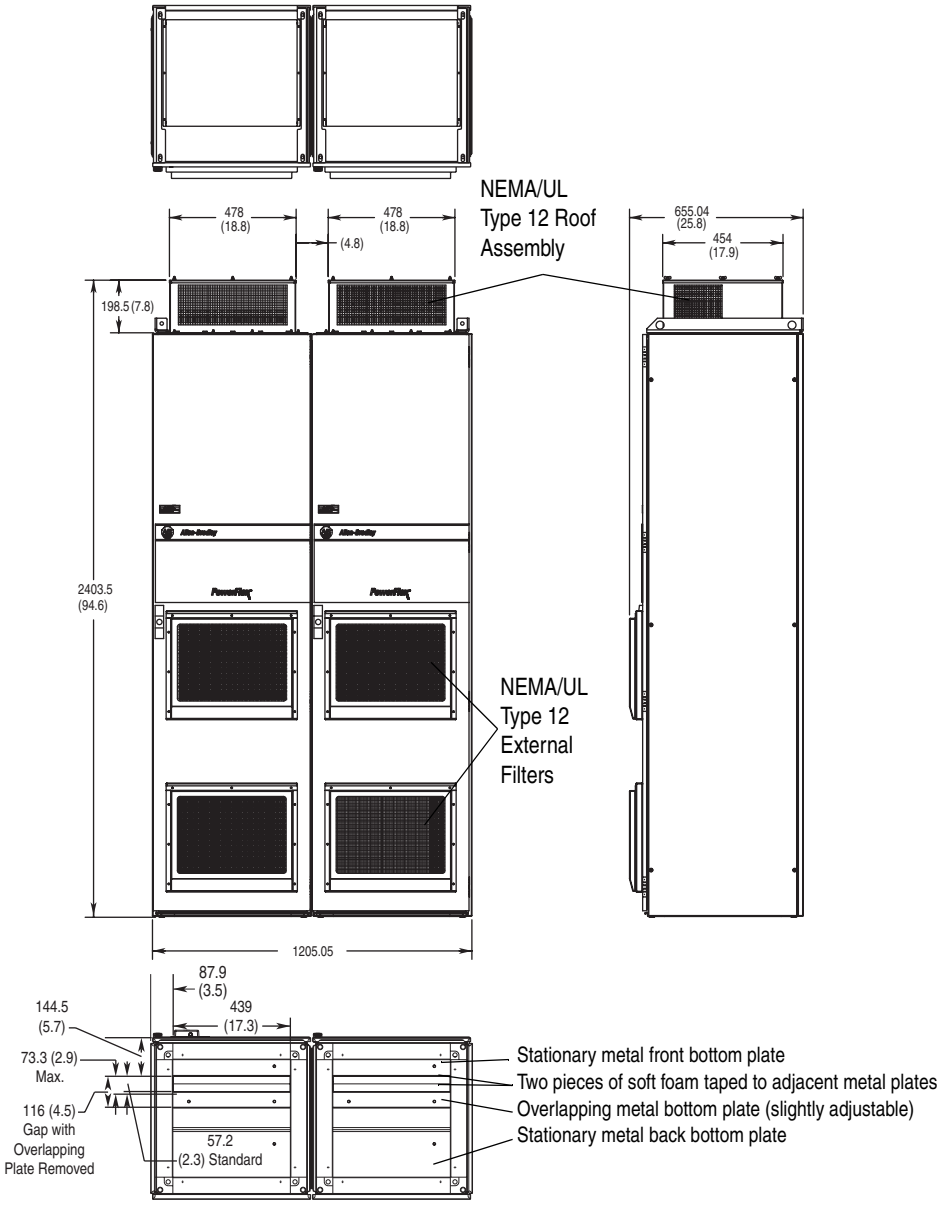
Figure 9.4 Enclosure Code B (NEMA/UL Type 1, IP21) and K (NEMA/UL Type 1, IP21 w/Conformal Coat)



Dimensions are in millimeters and (inches).

Figure 9.5 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Lifting and Mounting Frame 12 Drives

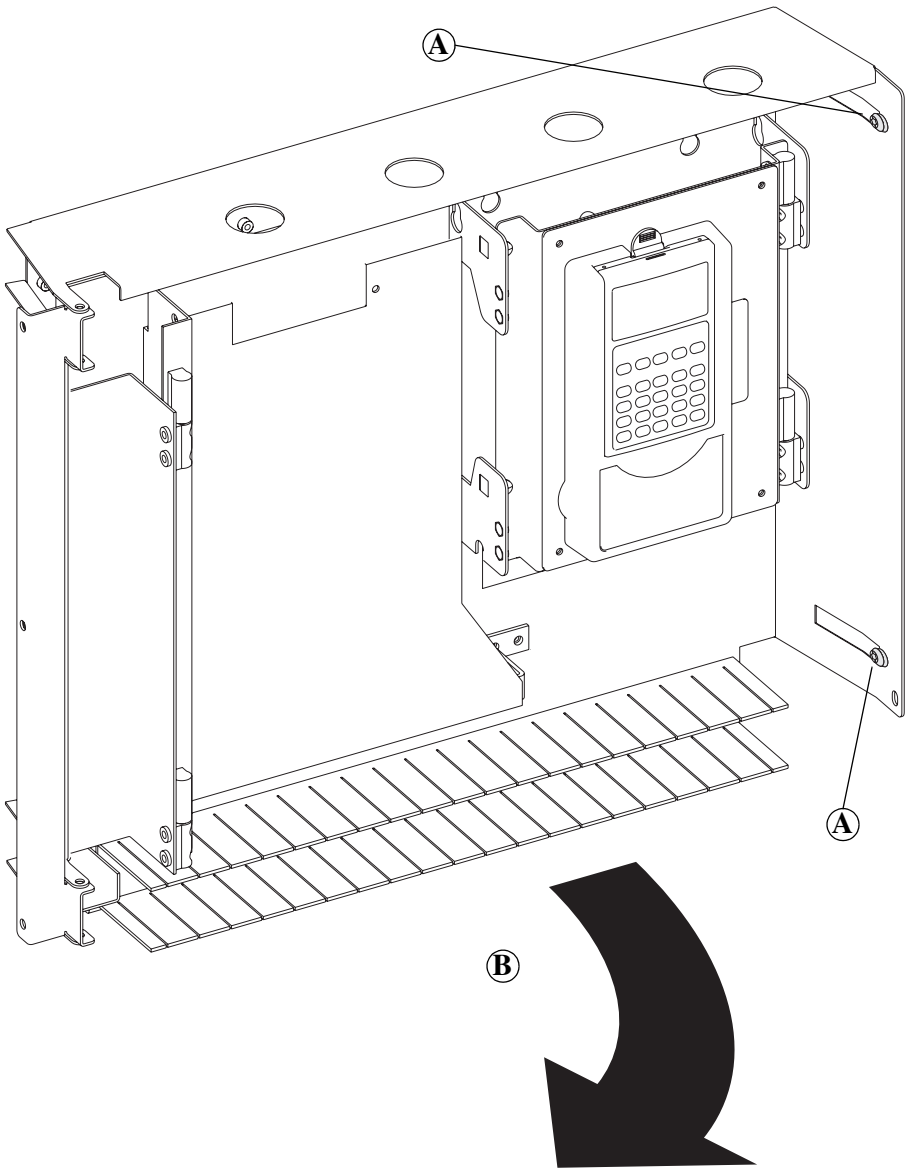
Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

Removing the Protective Covers

Moving the Control Frame

To gain access to the power wiring terminals, airflow plate and protective covers you may need to move the Control Frame out of the way. If you do not need to move the control frame, continue with "Removing the Airflow Plate" on page 9-7.

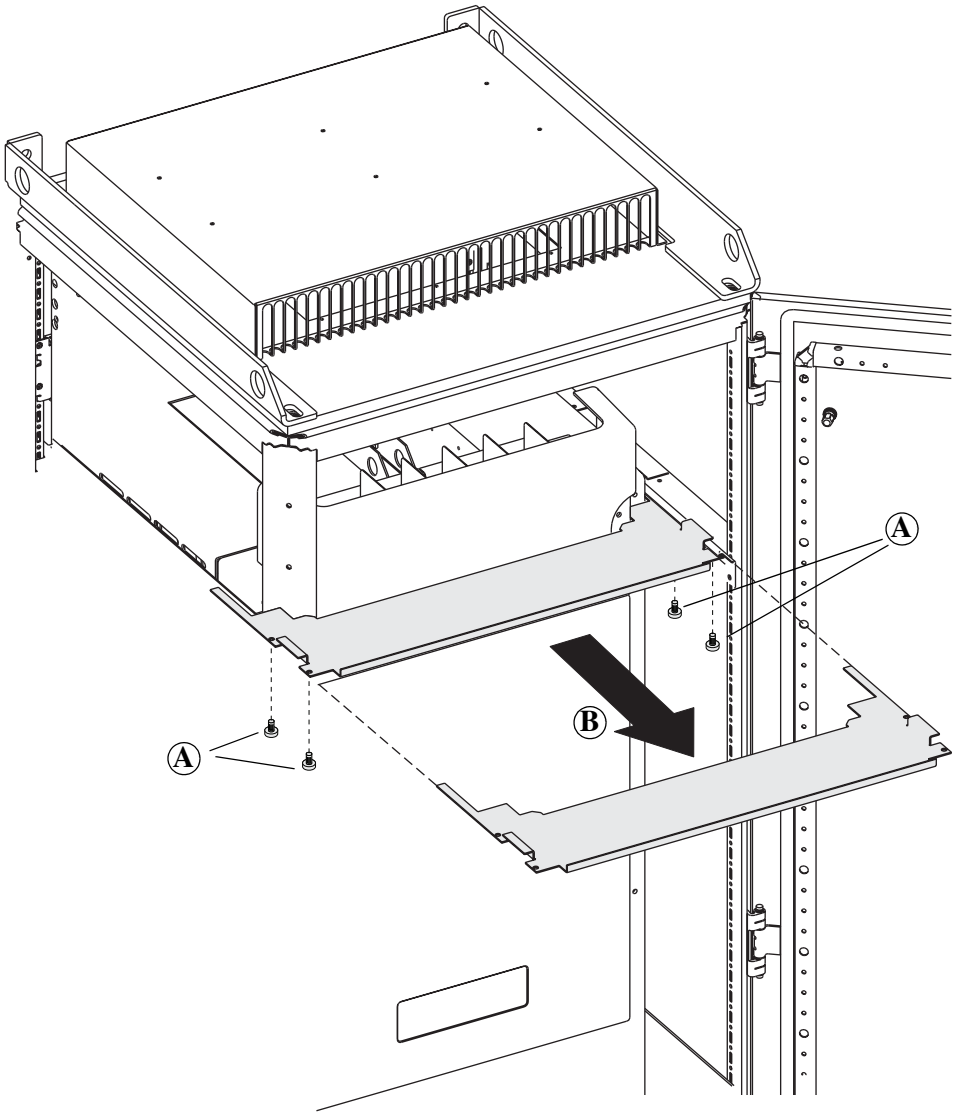
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure (Remove screws on early frame 10 drives).
Ⓑ	Swing the Control Frame out and away from the power structure.



Removing the Airflow Plate

The drive is equipped with a plate, just above the Control Frame, that directs air flow through the drive. You may need to remove this plate in order to access the protective covers and the power terminals. If you do not need to remove the airflow plate, continue with "Removing the Protective Covers" on page 9-8.

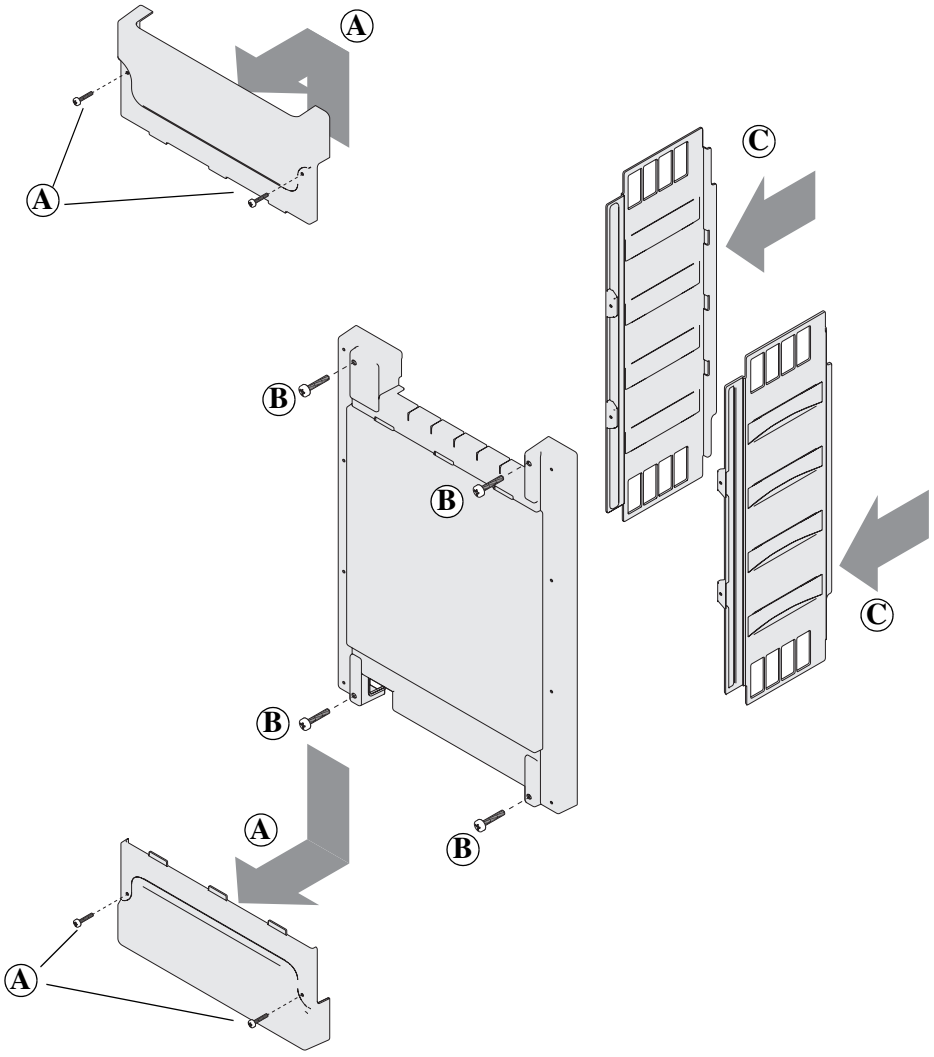
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.



Removing the Protective Covers

You must remove the protective covers to gain access to the Power structure.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure the top and bottom protective covers to the main front protective cover, then remove the top and bottom protective covers. ***Note:*** *you only need to remove the top and bottom covers to gain access to the power terminals. You can remove the other covers without removing the top and bottom ones.*
Ⓑ	Remove the four M5 POZIDRIV screws that secure the main front protective cover to the drive, then remove the protective cover.
Ⓒ	Remove the side protective covers.



Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 12 size drives are equipped with common mode capacitors and capacitors that are connected to the input terminals. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Should insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

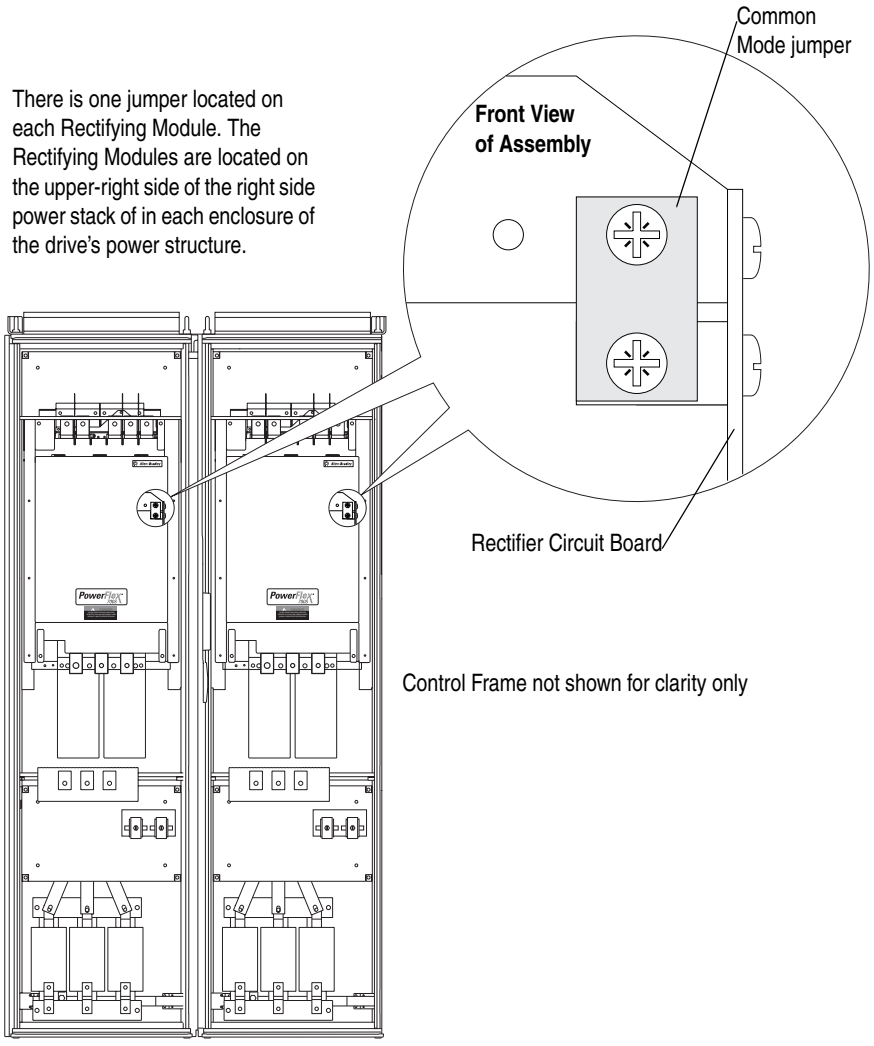
Installation on a Grounded B Phase Delta System

If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper to the disconnected position - refer to "Move the Common Mode Jumper to the Disconnected Position" on page 9-11.
- Must insulate terminal X4 on the Rectifier circuit board- refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 9-12.
- Must disconnect the small capacitors from the input terminals - refer to "Disconnect the Small Capacitors from the Input Terminals" on page 9-13.

Note: Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

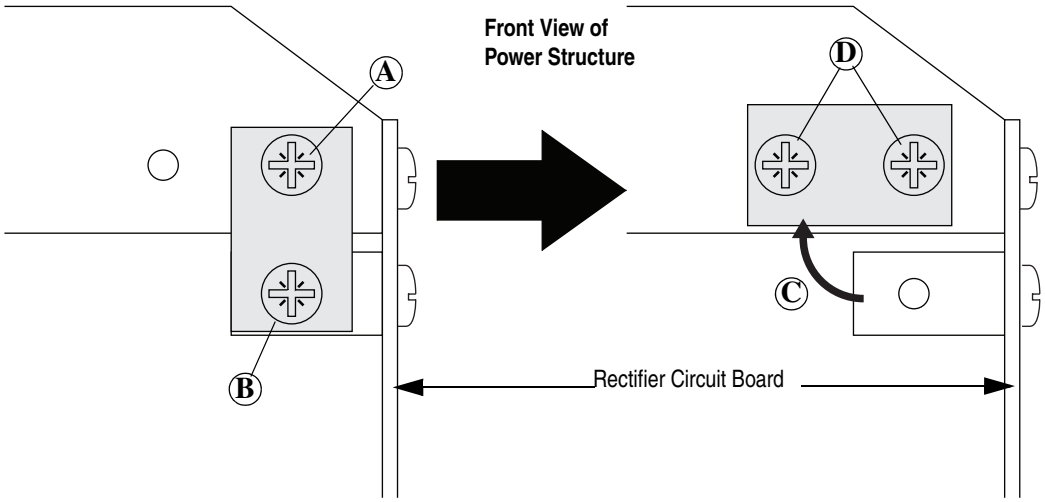
Figure 9.6 Common Mode Jumper and Rectifier Circuit Board Location



Move the Common Mode Jumper to the Disconnected Position

Follow the lettered steps below to move the common mode jumper to the disconnected position (refer to Figure 9.6 for jumper location):

Task	Description
Ⓐ	Loosen the upper screw.
Ⓑ	Remove the lower screw.
Ⓒ	Move the jumper to the horizontal position.
Ⓓ	Install and tighten the screws.

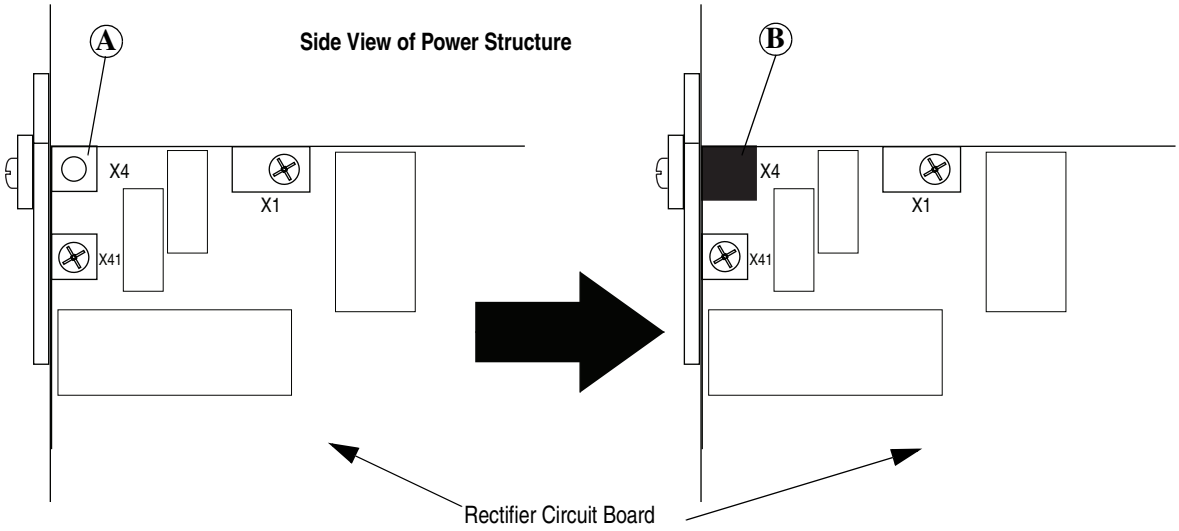


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board (refer to Figure 9.6 for Rectifier board location):

Task	Description
Ⓐ	Remove the screw from the X4 connection on the Rectifier circuit board.
Ⓑ	Insulate the top and bottom of the X4 connection on the Rectifier circuit board.

Important: Do not install the screw and washer that was removed from this connection.



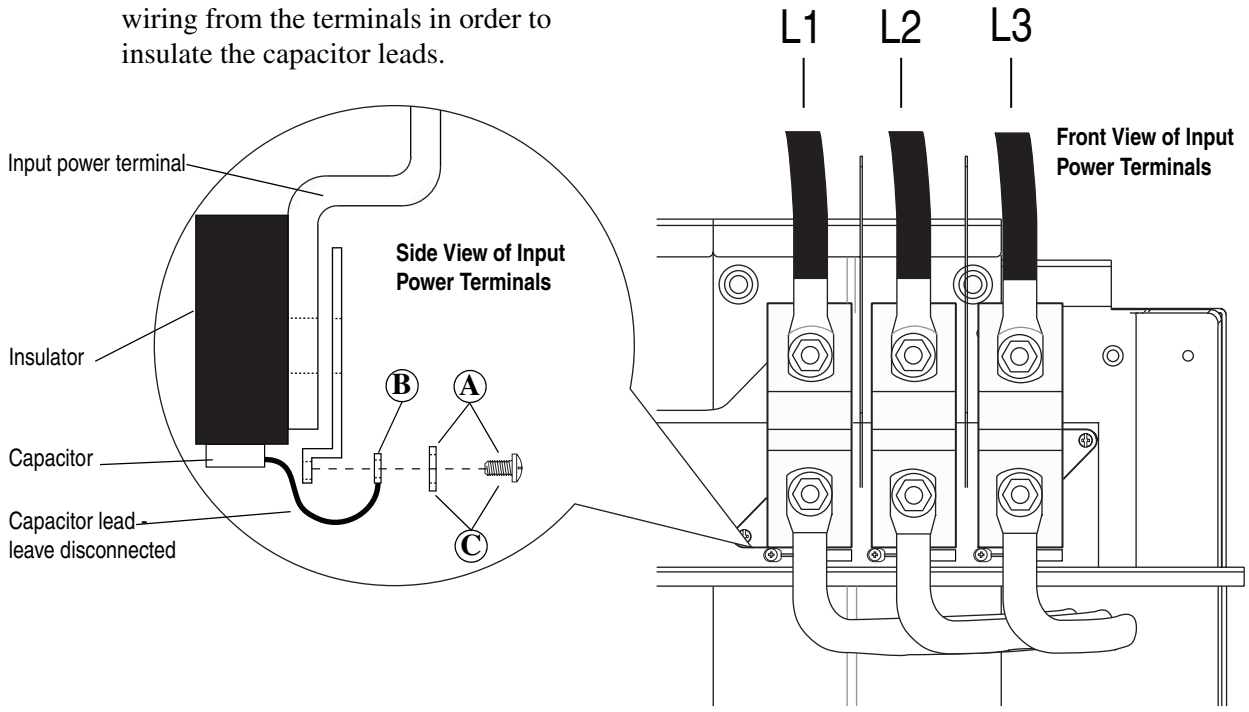
Disconnect the Small Capacitors from the Input Terminals

Follow the lettered steps below to disconnect the small capacitors from the input terminals:

Task	Description
Ⓐ	Remove the screws and lock washers that secure each of the three capacitor supply wires to the input power terminals.
Ⓑ	Insulate the capacitor leads and leave disconnected.
Ⓒ	Install and tighten the screws and lock washers only.

Important: Do not re-install the capacitor leads.

Important: It is not necessary to remove the power wiring from the terminals in order to insulate the capacitor leads.



Power Wiring

Input Power Wiring

Frame 12 drives utilize two parallel power structures, and therefore have two sets of AC input power terminals. You must supply power to both sets of input terminals. There are several methods for accomplishing this.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Figure 9.4 Frame 12 AC Wiring Example: Two Fuses per Phase

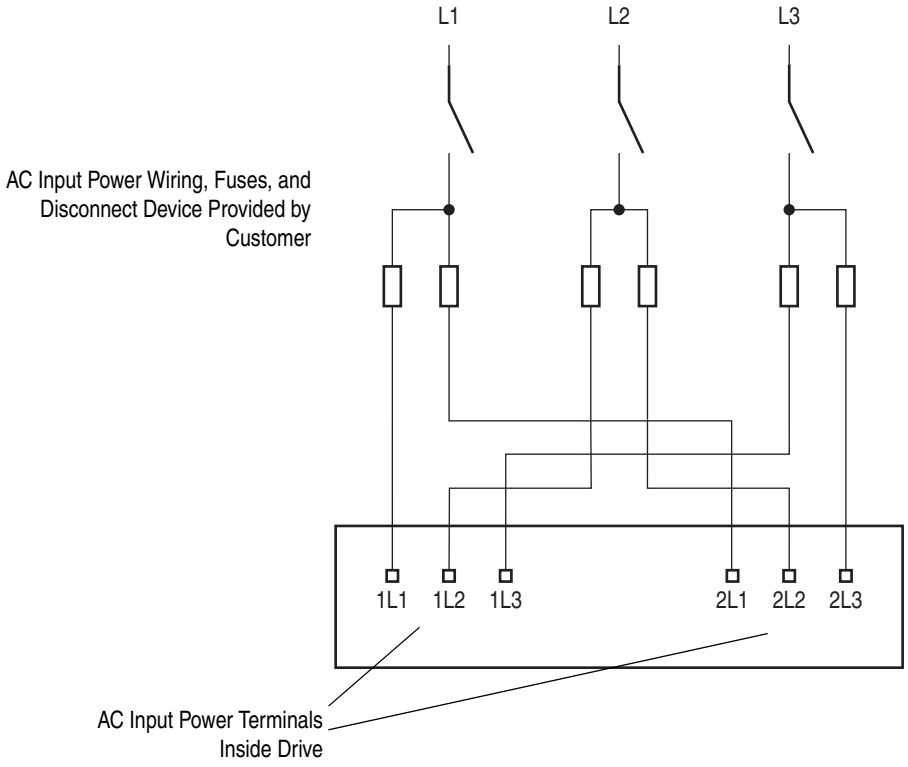


Figure 9.5 Frame 12 AC Wiring Example: One Fuse per Phase

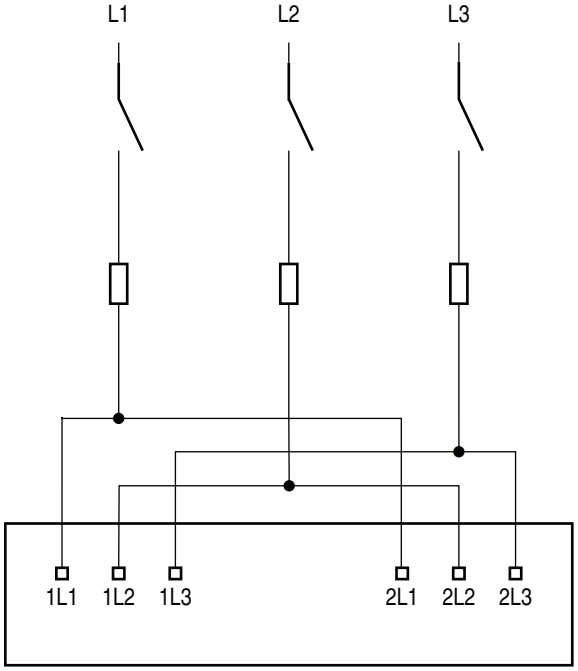
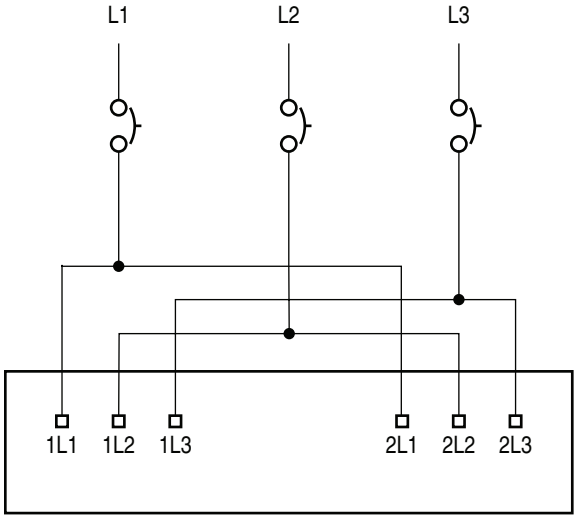


Figure 9.6 Frame 12 AC Wiring Example: Circuit Breaker



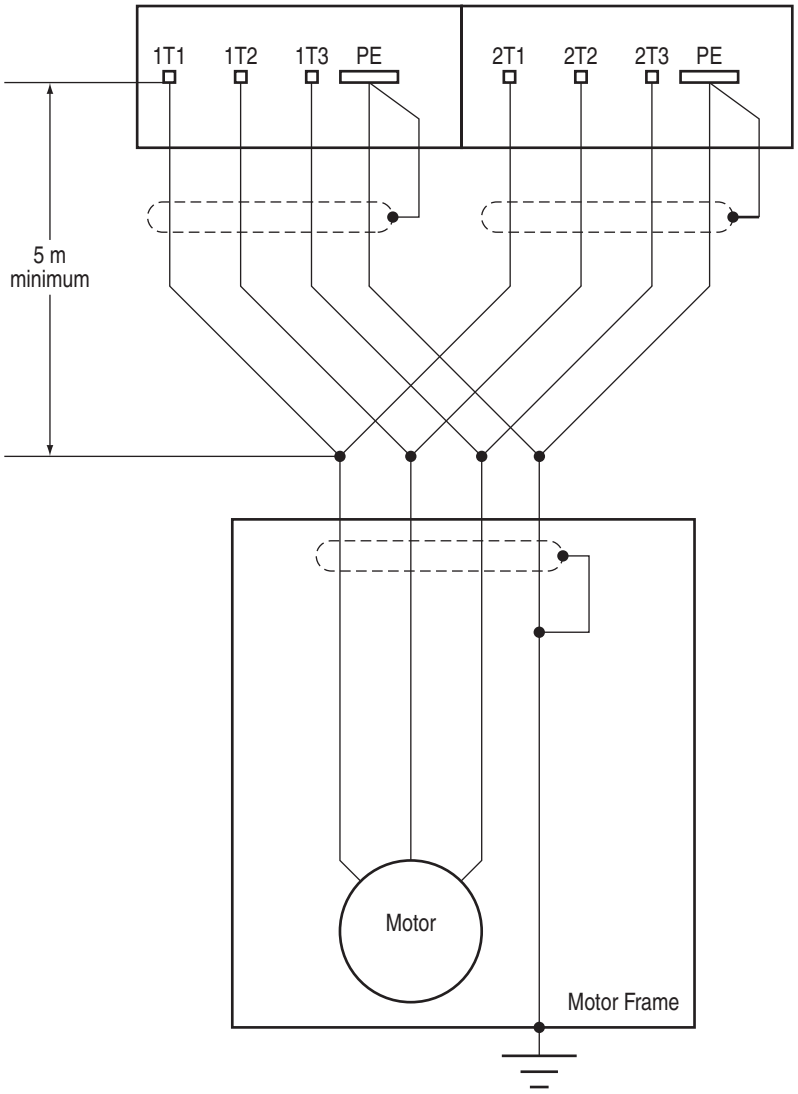
Output Power Wiring

Frame 12 drives utilize two parallel power structures, and therefore have two sets of output power terminals. You must connect the motor to both sets of output power terminals.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Important: The minimum cable length for parallel motor cables from the drive to the point where the cables connect is 5m (16.4 ft). Join the parallel cables at the motor end (not the drive end). Or, install a reactor on the output of each power module with a minimum of 5 µH prior to joining the parallel cables at the motor end.

Figure 9.7 Frame 12 Motor Wiring Example



Important: Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers" on page 9-6.)

Table 9.A Frame 12 Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block (3) 1L1, 1L2, 1L3, 2L1, 2L2, 2L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❷	Output Power Terminal Block (3) 1U/1T1, 1V/1T2, 1W/1T3, 2U/2T1, 2V/2T2, 2W/2T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❸	SHLD Terminal, PE, Motor Ground (3)	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M10
❹	DC Bus (3) (2 Terminals; DC–, DC+)	DC input or external brake	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❺	Cable Clamp for Shield					

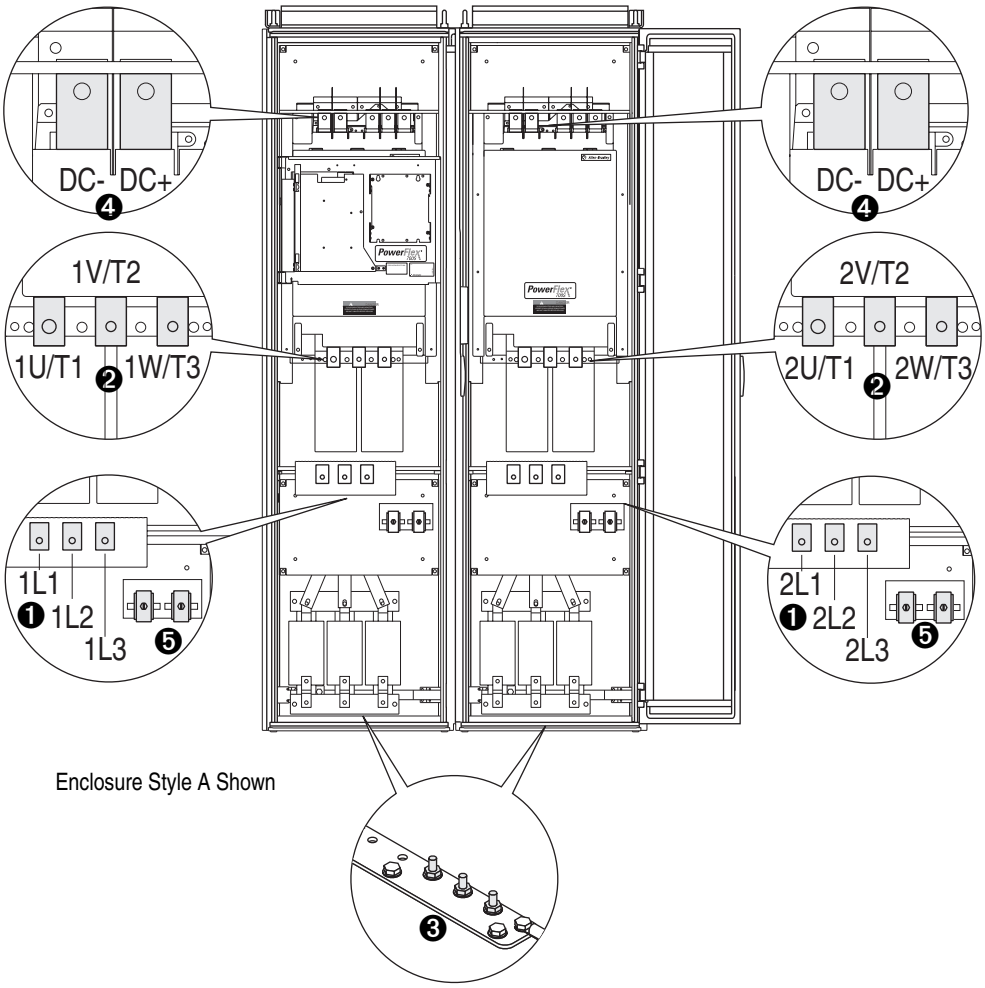
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(2) Do Not exceed maximum wire size. Parallel connections may be required.

(3) These connections are bus bar type terminations and require the use of lug type connectors.

(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.

Figure 9.7 Terminal Locations



Enclosure Style A Shown

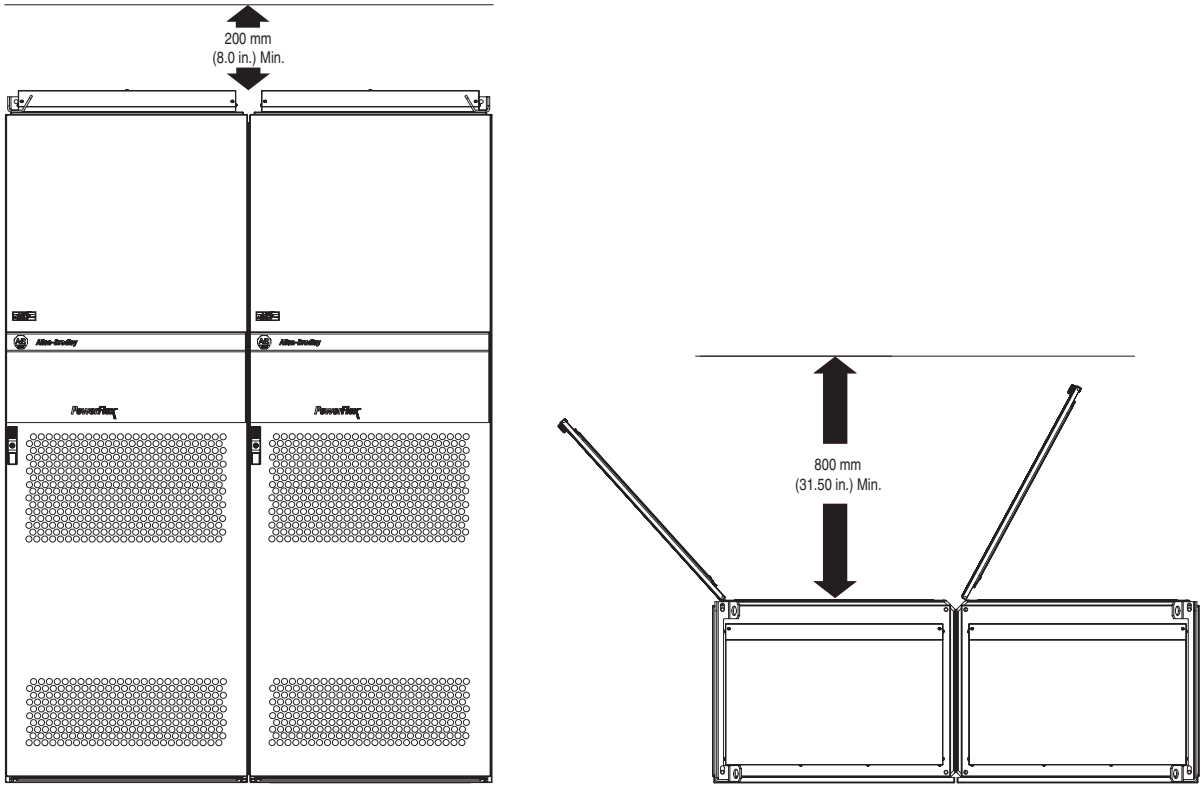
Notes:

Frame 13 Installation

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances



1600 mm, Style “A” Enclosure Shown.

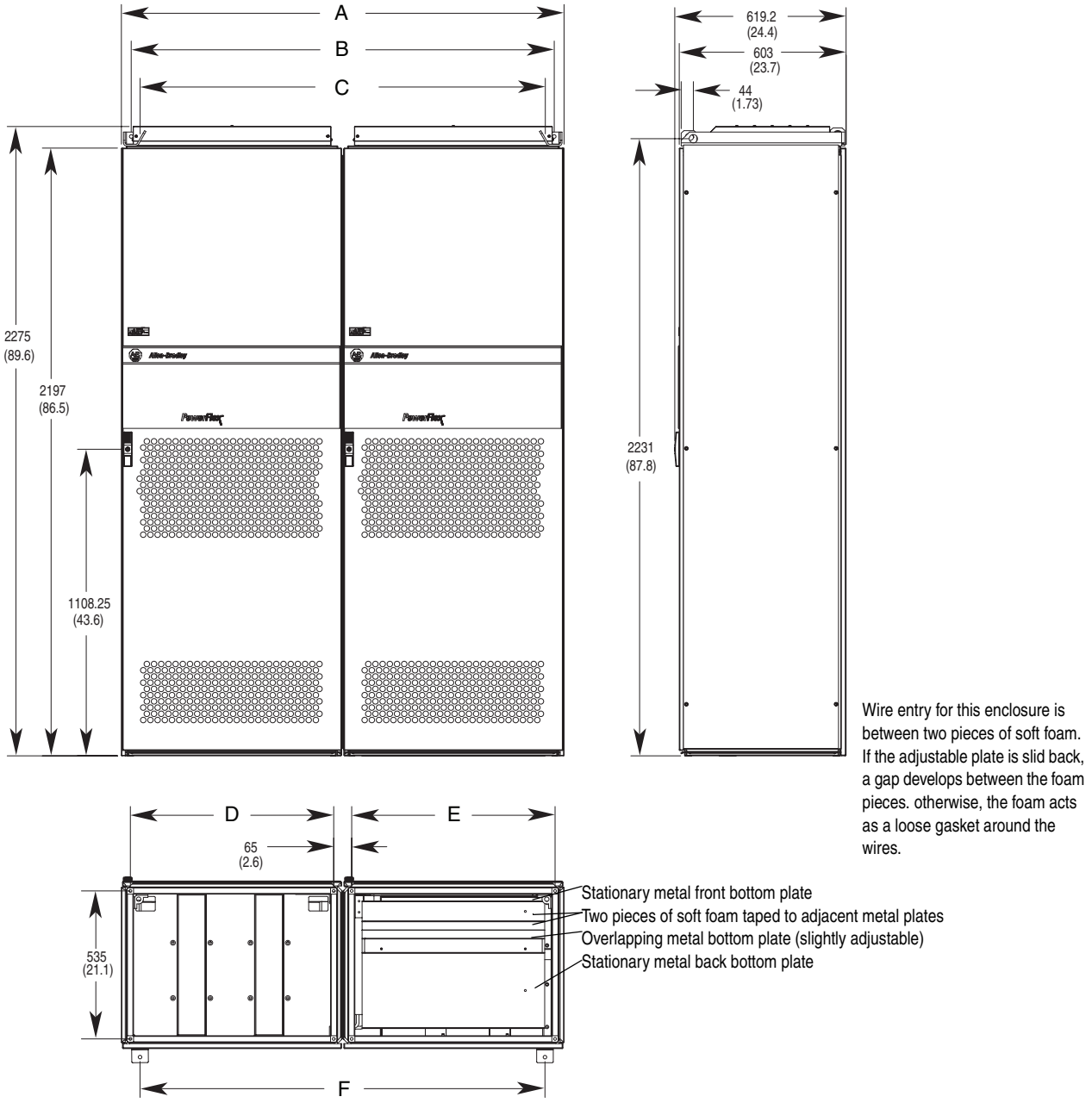
Operating Temperatures

Frame 13 drives require a minimum of 4200 m^3/h (2472 cfm) of cooling air for the Inverter unit and 1150 m^3/h (677 cfm) of cooling air for each Converter unit.

PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H	All	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
700S	400/480V AC (540/650V DC)	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	920, 1030	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	1180	0 to 35° C (32 to 95° F)	0 to 35° C (32 to 95° F)

Dimensions

Figure 10.1 Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)



Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. otherwise, the foam acts as a loose gasket around the wires.

Table 10.A Frame 13 Dimensions for Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Voltage Class	Amps	A	B	C	D	E	F
400/480V AC (540/650V DC)	1150	1412 (56)	1329 (52)	1264 (50)	535 (21)	735 (29)	1264 (50)
	1300	1600 (63)	1529 (60)	1464 (58)	735 (29)	735 (29)	1464 (58)
	1450						
600/690V AC (810/932V DC)	920	1412 (56)	1329 (52)	1264 (50)	535 (21)	735 (29)	1264 (50)
	1030						
	1180						

Dimensions are in mm and (in.)

Figure 10.2 Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

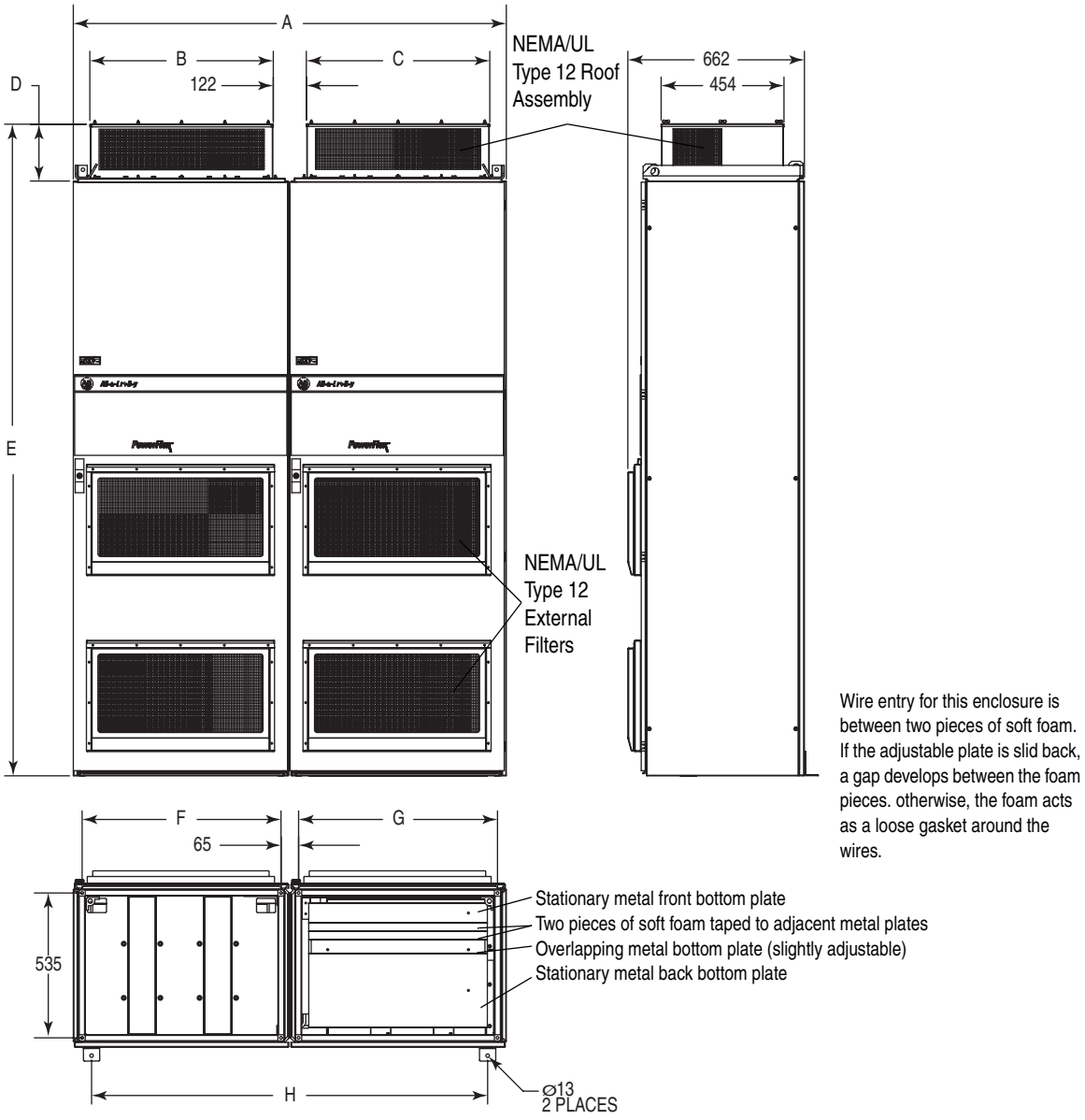


Table 10.B Frame 13 Dimensions for Enclosure Code H (NEMA/UL Type 12 - IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Voltage Class	Amps	A	B	C	D	E	F	G	H
400/480V AC (540/650V DC)	1150	1412 (56)	478 (18.8)	678 (26.7)	1 @ 242 (9.5) 1 @ 213 (8.4)	2443.5 (104.5) max.	535 (21)	735 (29)	1264 (50)
	1300	1600 (63)	678 (26.7)	678 (26.7)	2 @ 242 (9.5)	2443.5 (104.5)	735 (29)	735 (29)	1464 (58)
	1450								
600/690V AC (810/932V DC)	920	1412 (56)	478 (18.8)	678 (26.7)	1 @ 242 (9.5) 1 @ 213 (8.4)	2443.5 (104.5) max.	535 (21)	735 (29)	1264 (50)
	1030								
	1180								

Dimensions are in millimeters and (inches).

Lifting and Mounting Frame 13 Drives

Enclosed Frame 13 Drives with DC Input

Enclosed Frame 13 drives with DC input are shipped with the control pan mounted in the motor connection area of the right-hand enclosure. The control pan must be moved from this location to a location in the adjacent enclosure, away from the power connections.

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

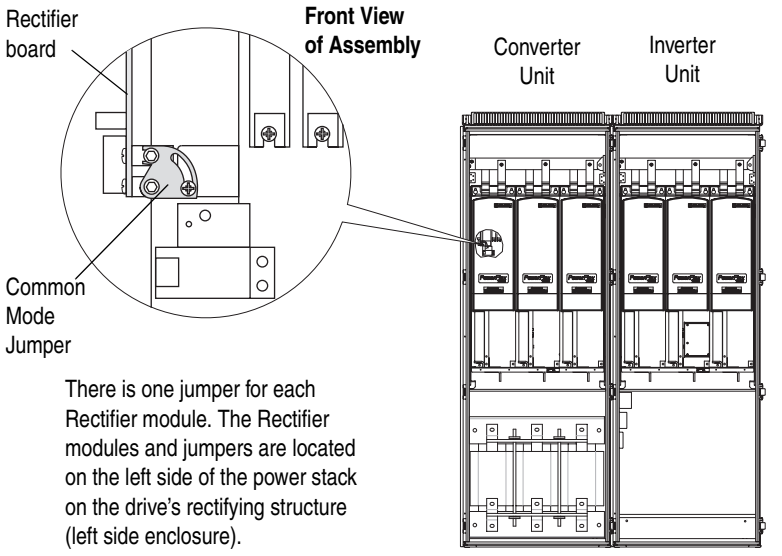
Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 13 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

To access and move the common mode jumper(s) and disconnect the capacitor connections you must first move the Control frame and remove the protective covers from the Converter unit. These steps are detailed on the following pages.

Note: Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

Figure 10.3 Common Mode Jumper and Rectifier Circuit Board Location

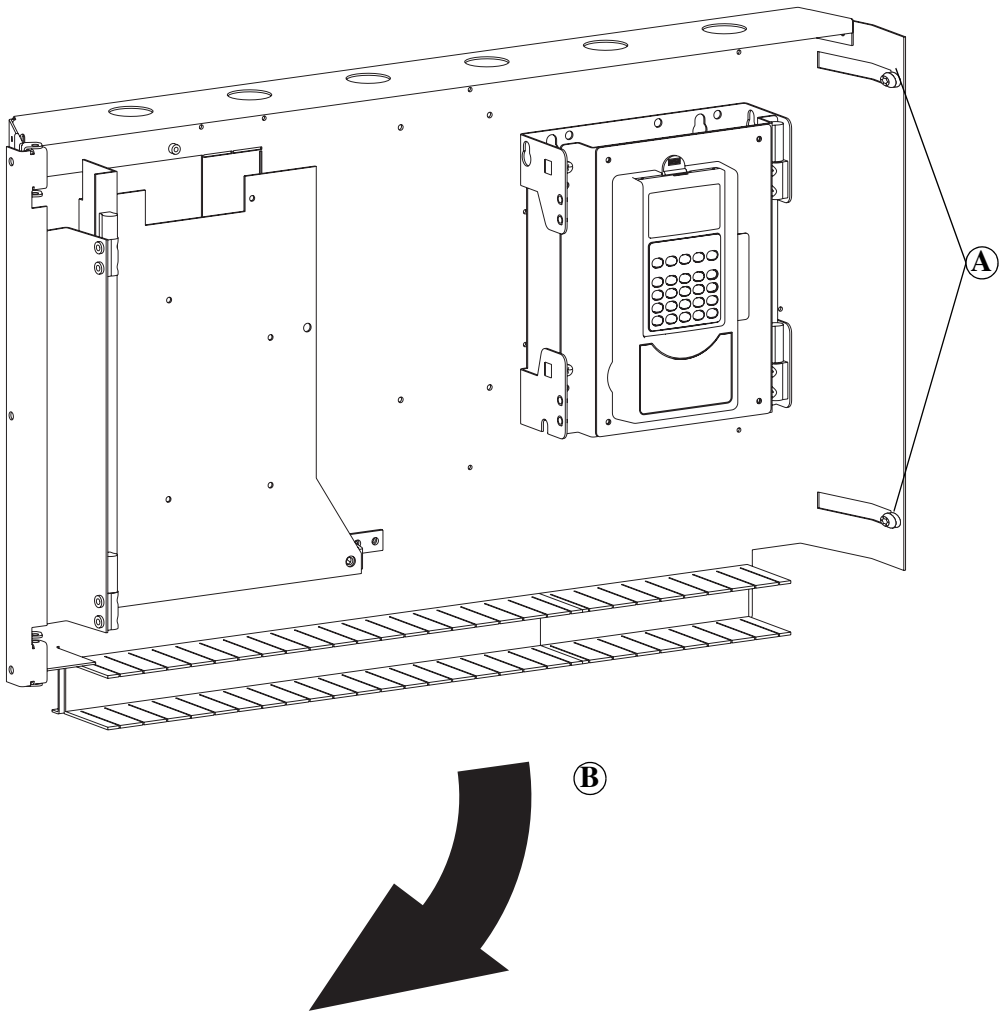


Removing the Protective Covers from the Converter Unit

Moving the Control Frame

You must move the Control Frame in order to access and remove the protective covers from the drive's Converter unit.

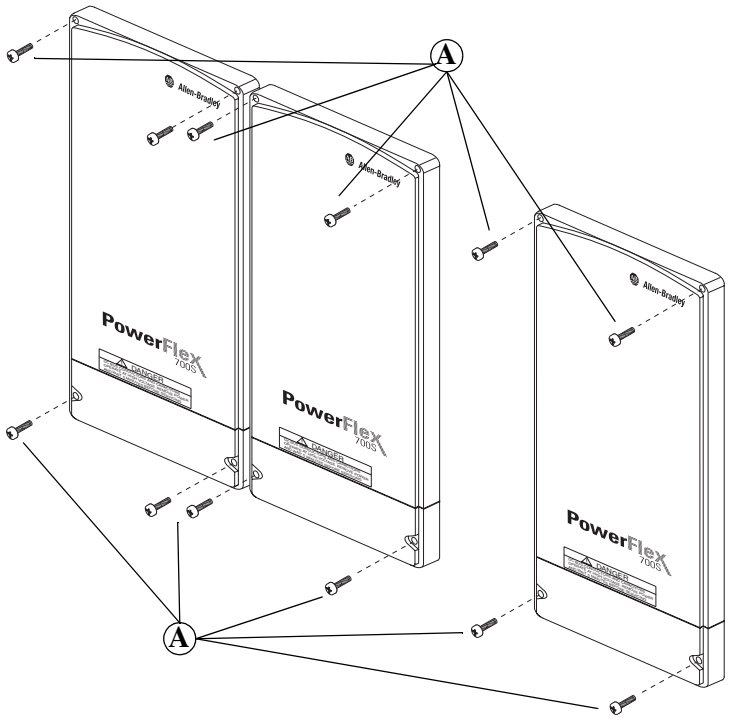
Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure.
Ⓑ	Swing the Control Frame out and away from the converter unit.



Removing the Protective Covers

You must remove the protective covers from the converter unit to gain access to the common mode jumper(s) and Rectifier circuit board.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers.



Installation on an Ungrounded Distribution System or High Resistive Ground

If you are installing a **400/480V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Should insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

Installation on a Grounded B Phase Delta System

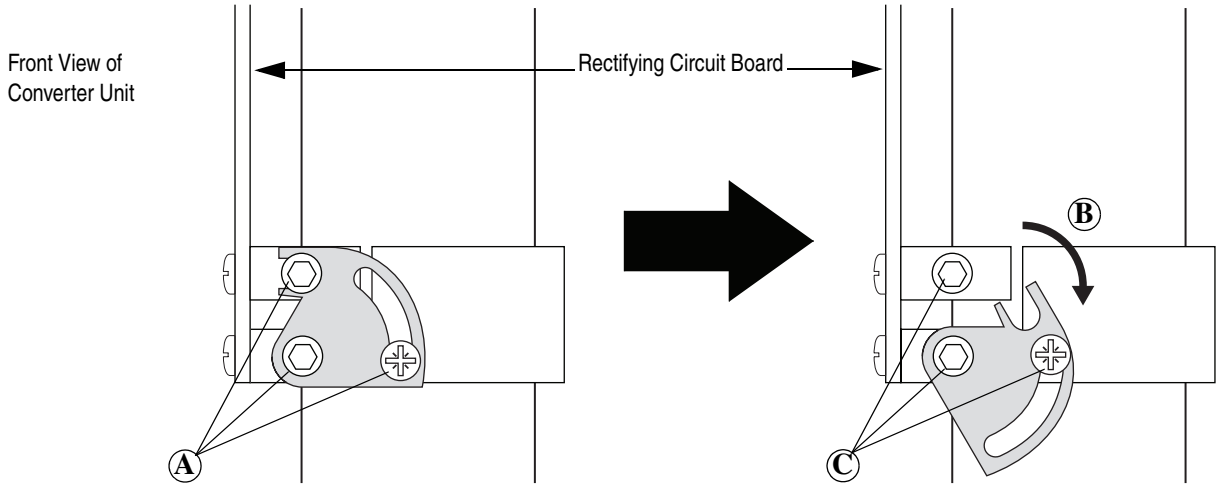
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 10-8.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 10-9.

Move the Common Mode Jumper(s) to the Disconnected Position

Follow the lettered steps below to move the common mode jumper(s) to the disconnected position for each converter unit (refer to Figure 10.3 for jumper location).:

Task	Description
Ⓐ	Loosen the screws and two fasteners that secure the jumper.
Ⓑ	Rotate the jumper to the lower position.
Ⓒ	Tighten the screw and two fasteners.

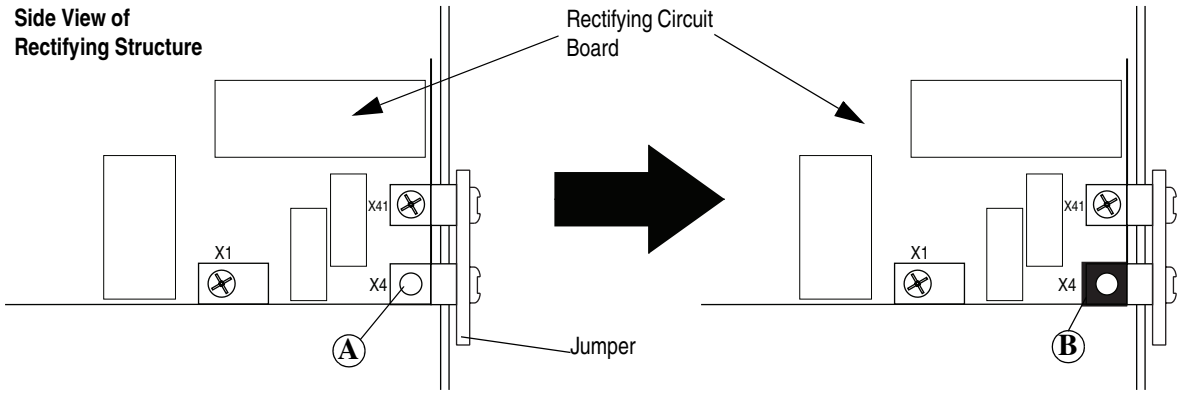


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board for each converter unit (refer to Figure 10.3 for Rectifier board location):

Task	Description
Ⓐ	Remove the screw from the X4 connection on the Rectifier circuit board.
Ⓑ	Insulate the top and bottom of the X4 connection on the Rectifier circuit board.

Important: Do not install the screw and washer that was removed from this connection.

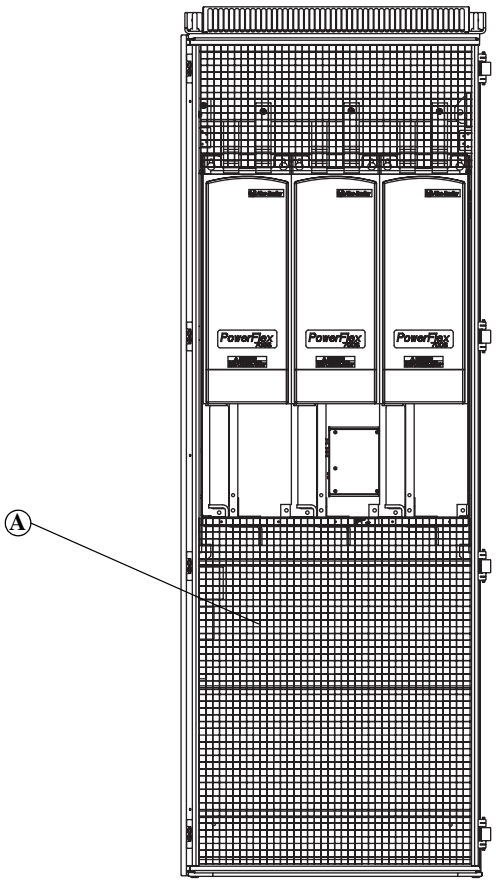


Removing the Protective Covers from the Inverter Unit

Removing the Lower Protective Screen

To access the power terminals, you must first remove the lower protective screen (on NEMA/UL Type 1 and Type 12 enclosures).

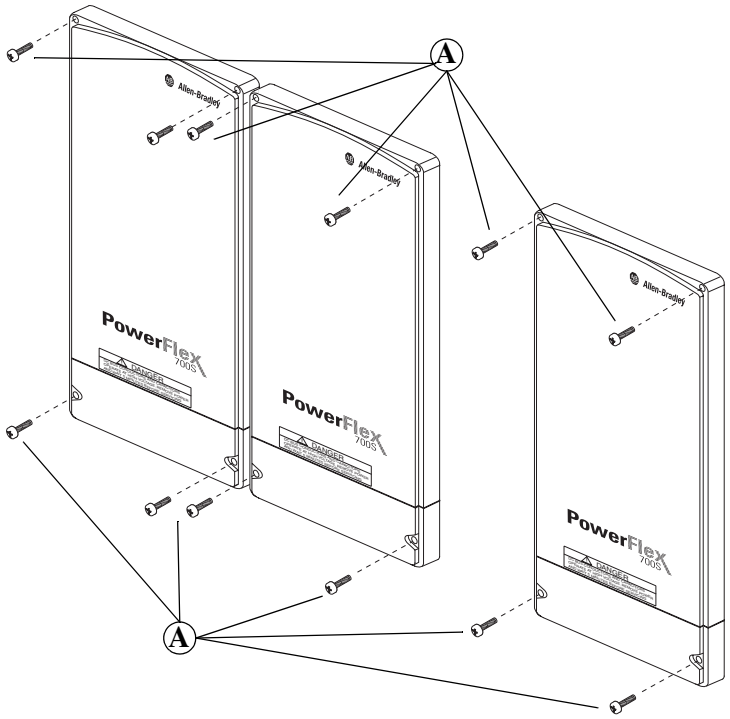
Task	Description
Ⓐ	Remove the screws that secure the lower protective screen to the right side enclosure only and remove the screen.



Removing the Protective Covers

You must remove the protective covers to gain access to the Inverter units.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers.



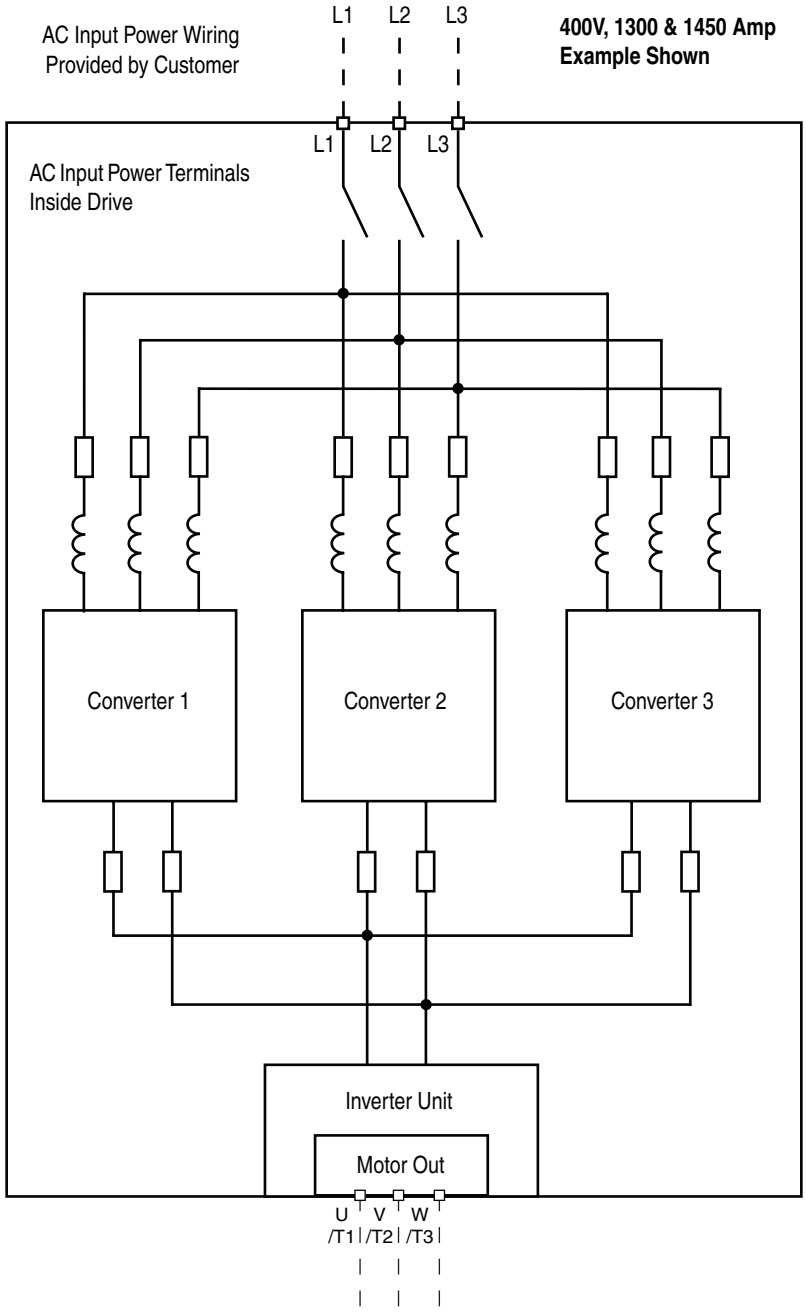
Power Wiring

Frame 13 400 and 600 Volt Class AC Input Power Wiring

Frame 13 size drives utilize two or three parallel power structures that are pre-connected to line reactors through a fused input switch.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Figure 10.4 Frame 13 AC Wiring Example: Three Internal Fuses per Phase

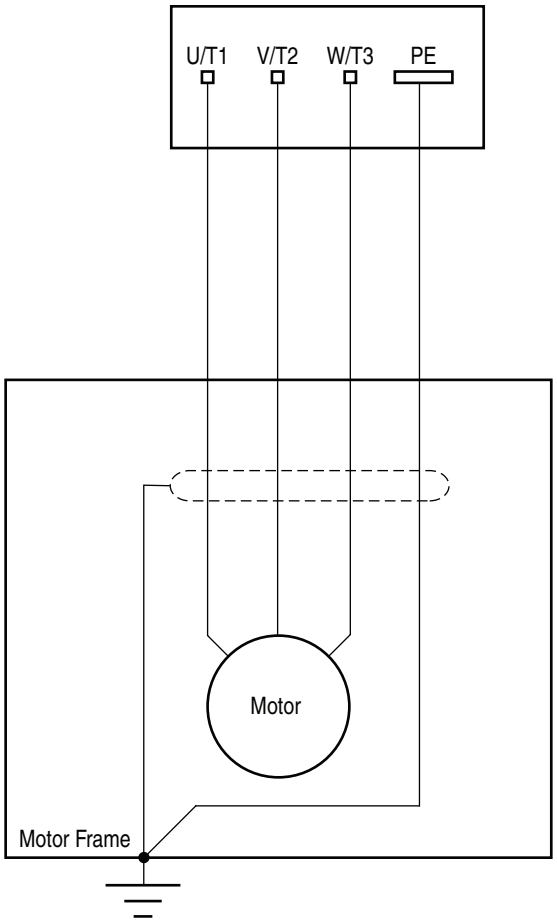


Output Power Wiring

Connect the motor to the output power terminals.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Figure 10.5 Frame 13 Motor Wiring Example



Important: Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers from the Converter Unit" on page 10-6 and "Removing the Protective Covers from the Inverter Unit" on page 10-10.)

Table 10.C Frame 13 Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block (1) L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❷	Output Power Terminal Block(3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❸	SHLD Terminal, PE, Motor Ground (3)	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M10
❹	DC Bus(3) (3 Terminals; DC–, DC+)	DC input or external brake	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12

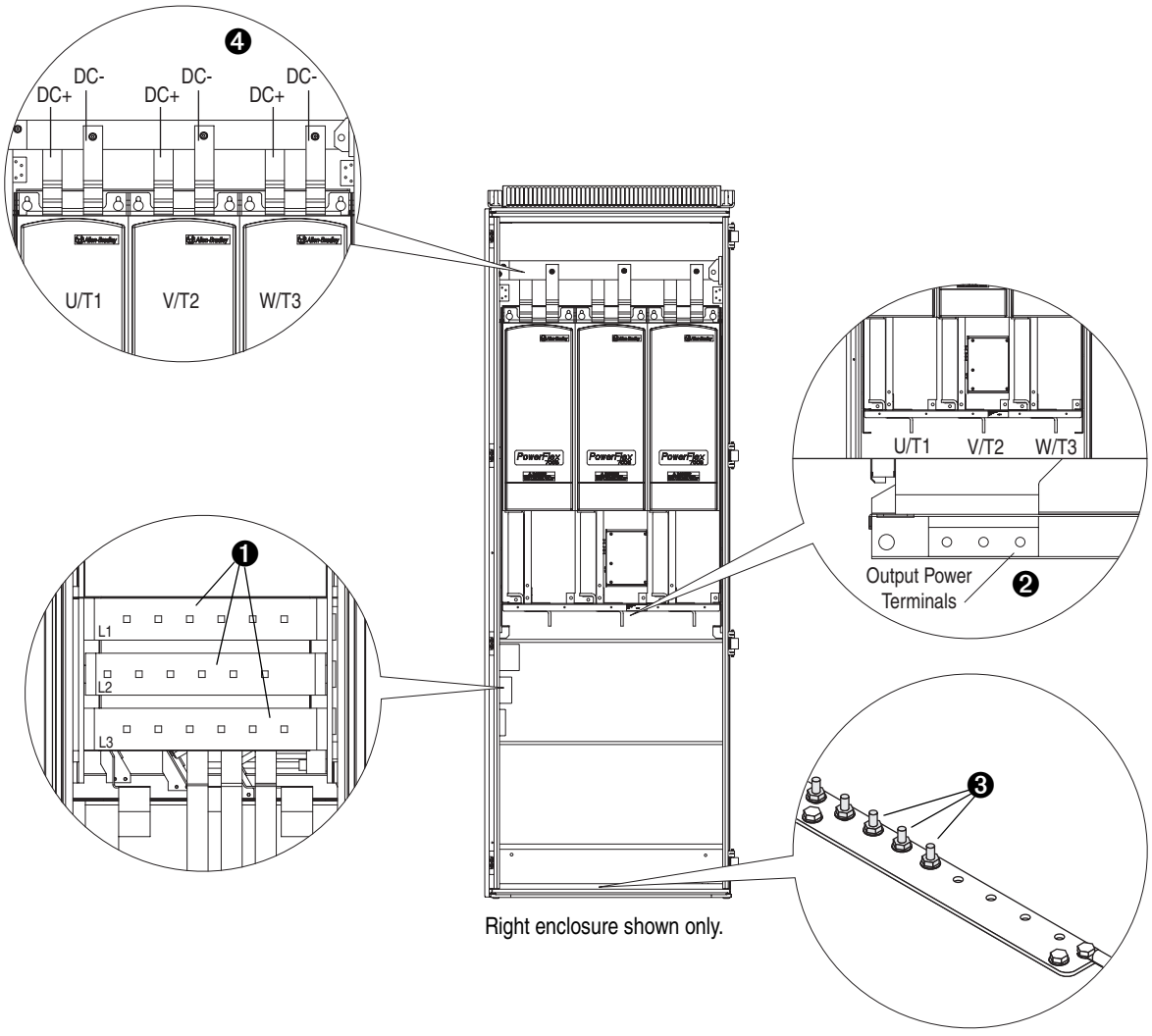
(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.

(2) Do Not exceed maximum wire size. Parallel connections may be required.

(3) These connections are bus bar type terminations and require the use of lug type connectors.

(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.

Figure 10.6 Frame 13 Drive Terminal Locations

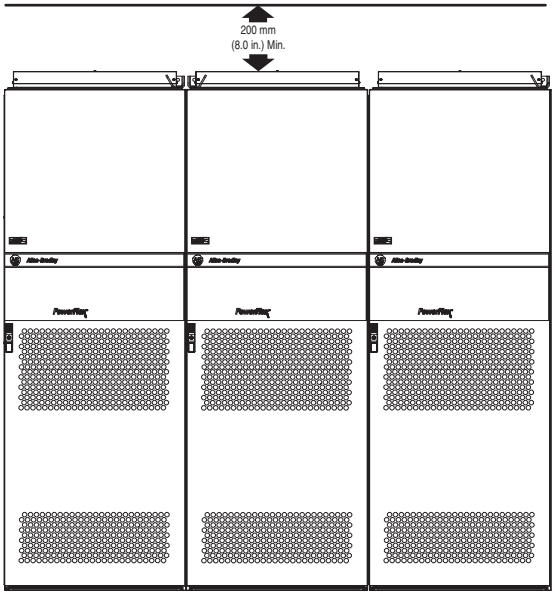


Frame 14 Installation

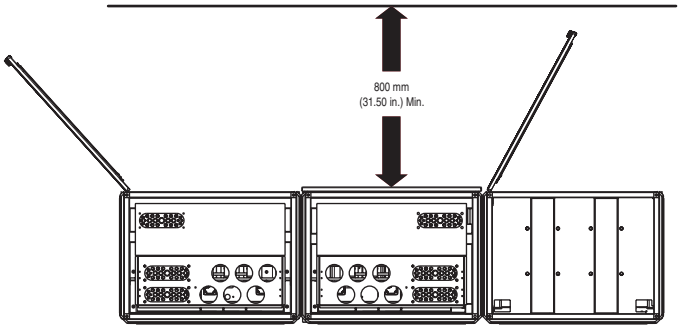
Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All information in Chapter 1 “General Installation Information” and in this chapter must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. Rockwell Automation, Inc. cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Minimum Mounting Clearances



1500A Drive - 2400 mm Enclosure Shown.



Operating Temperatures

Frame 14 drives require a minimum of 4200 m^3/h (2472 cfm) of cooling air for each Inverter unit and 1150 m^3/h (677 cfm) of cooling air for each Converter unit.

PowerFlex Drive	Voltage Class	Amp Rating	Surrounding Air Temperature	
			Normal Duty	Heavy Duty
700H	400/480V AC (540/650V DC)	All	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	1500, 1900	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)
	600/690V AC (810/932V DC)	2250	0 to 35° C (32 to 95° F)	0 to 35° C (32 to 95° F)
700S	600/690V AC (810/932V DC)	1500	0 to 40° C (32 to 104° F)	0 to 40° C (32 to 104° F)

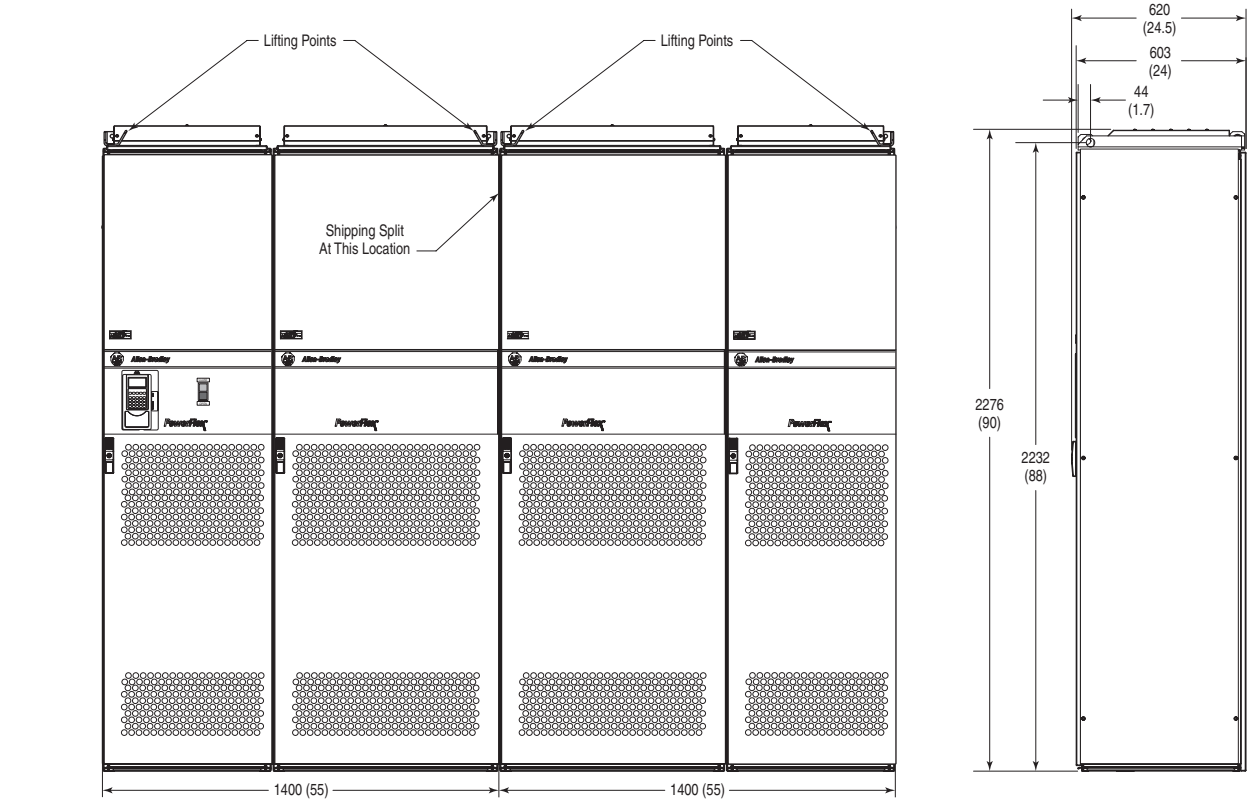
Table 11.A Frame 14 Number of Inverter and Converter Units Per Drive

Voltage Class	Amp Rating	No. Converter Units	No. Inverter Units
400/480V AC	1700, 2150	4	6
	2700	6	6
600/690V AC	1500	3	6
	1900, 2250	4	6

Dimensions

Figure 11.1 Drives Above 1500 A, 2800 mm Enclosure Code A (NEMA/UL Type 1, IP21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).



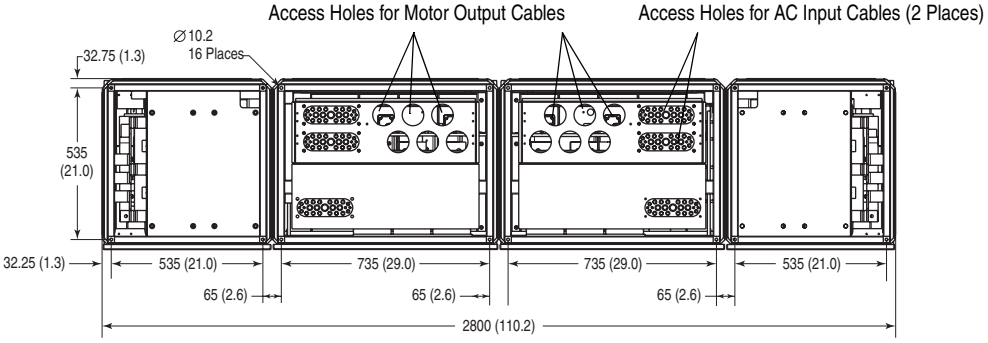


Figure 11.2 Drives Above 1500 A 2800 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).

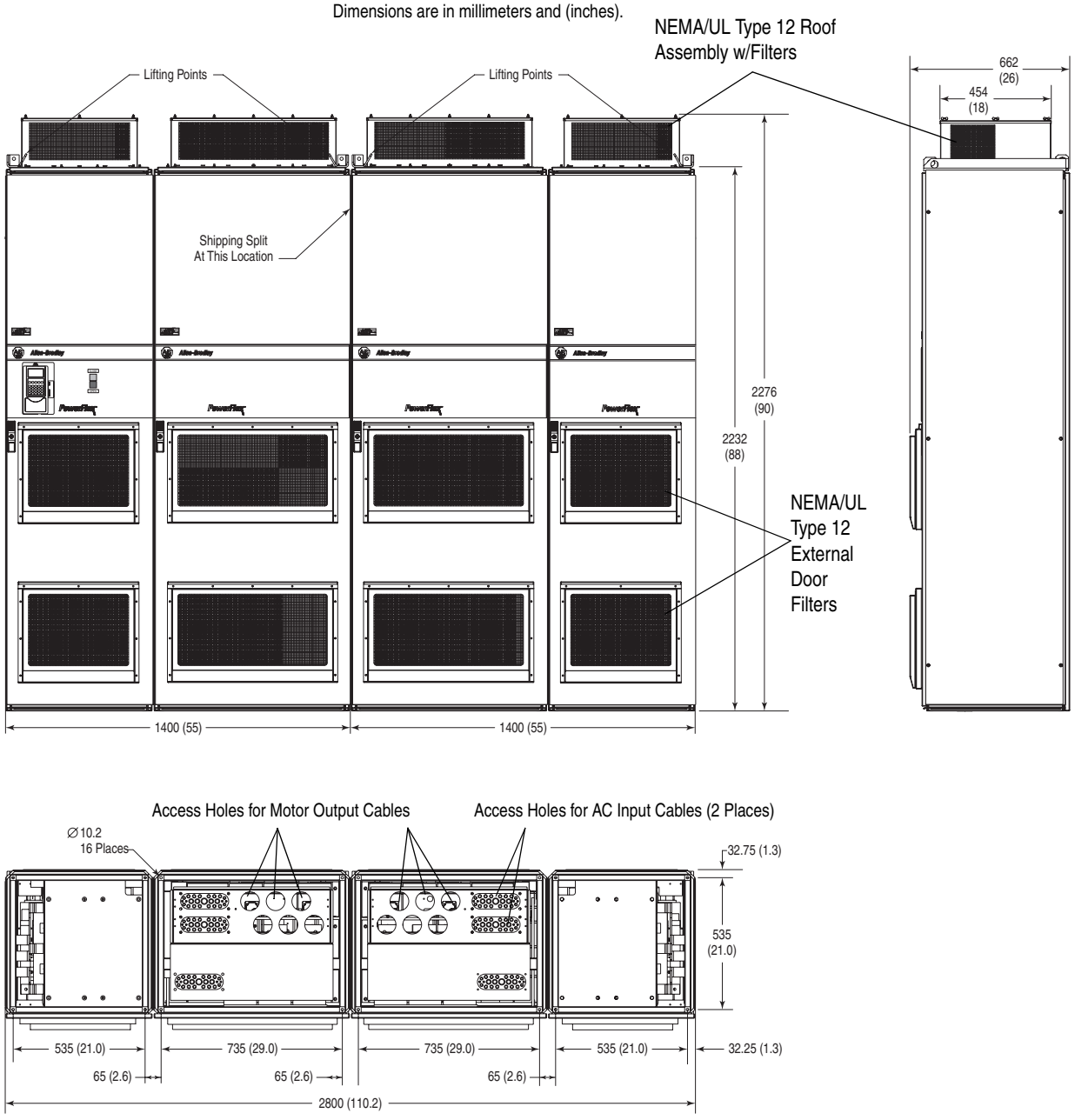
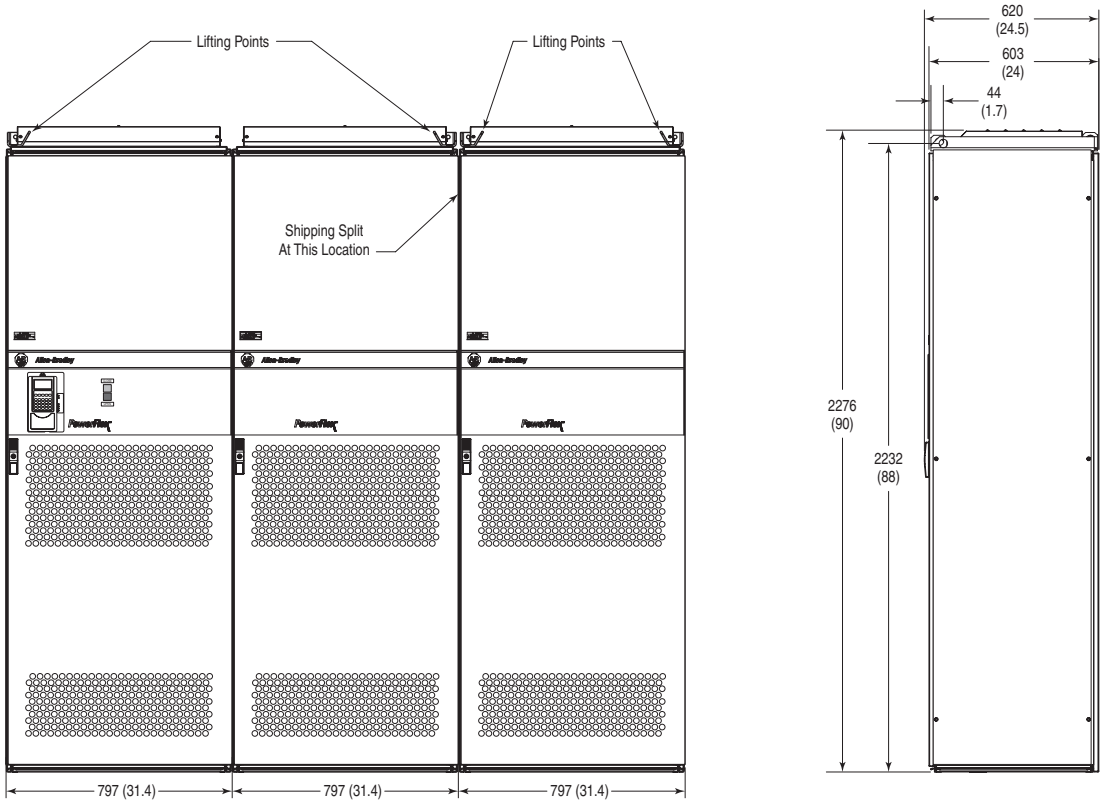


Figure 11.3 1500 A Drives 2400 mm Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).



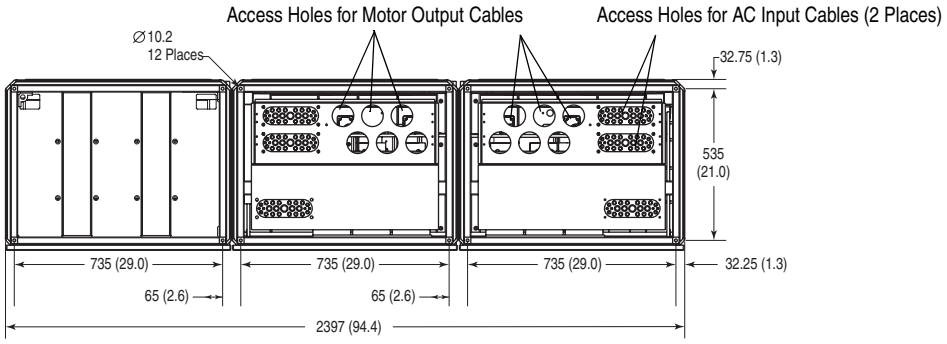
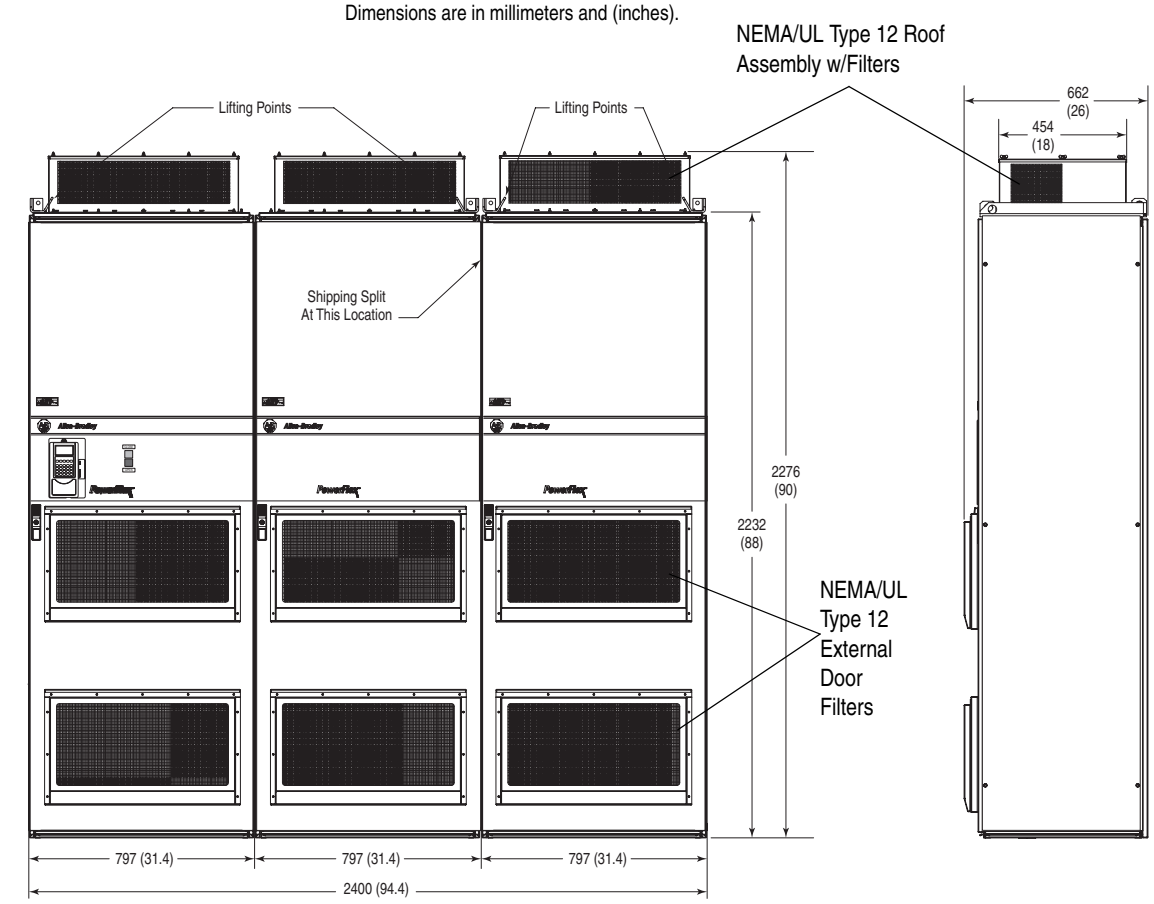


Figure 11.4 1500 A Drives 2400 mm Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).



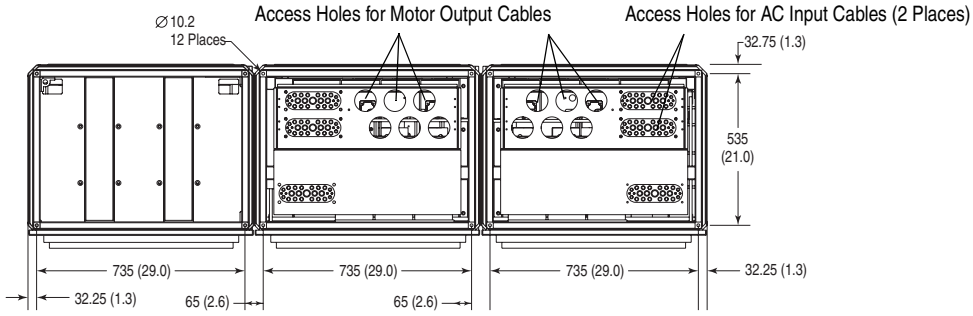
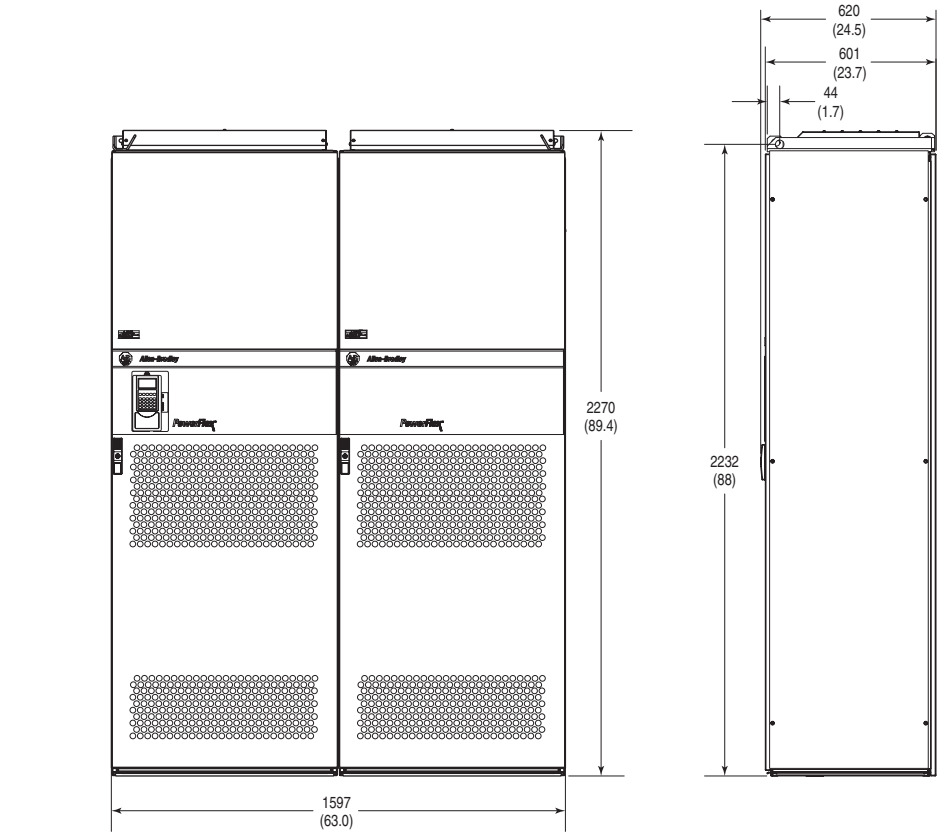
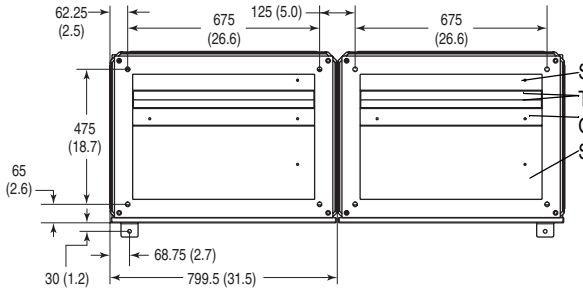


Figure 11.5 DC Input Drive Enclosure Code A (NEMA/UL Type 1, IP 21) and M (NEMA/UL Type 1, IP21 w/Conformal Coat)

Dimensions are in millimeters and (inches).



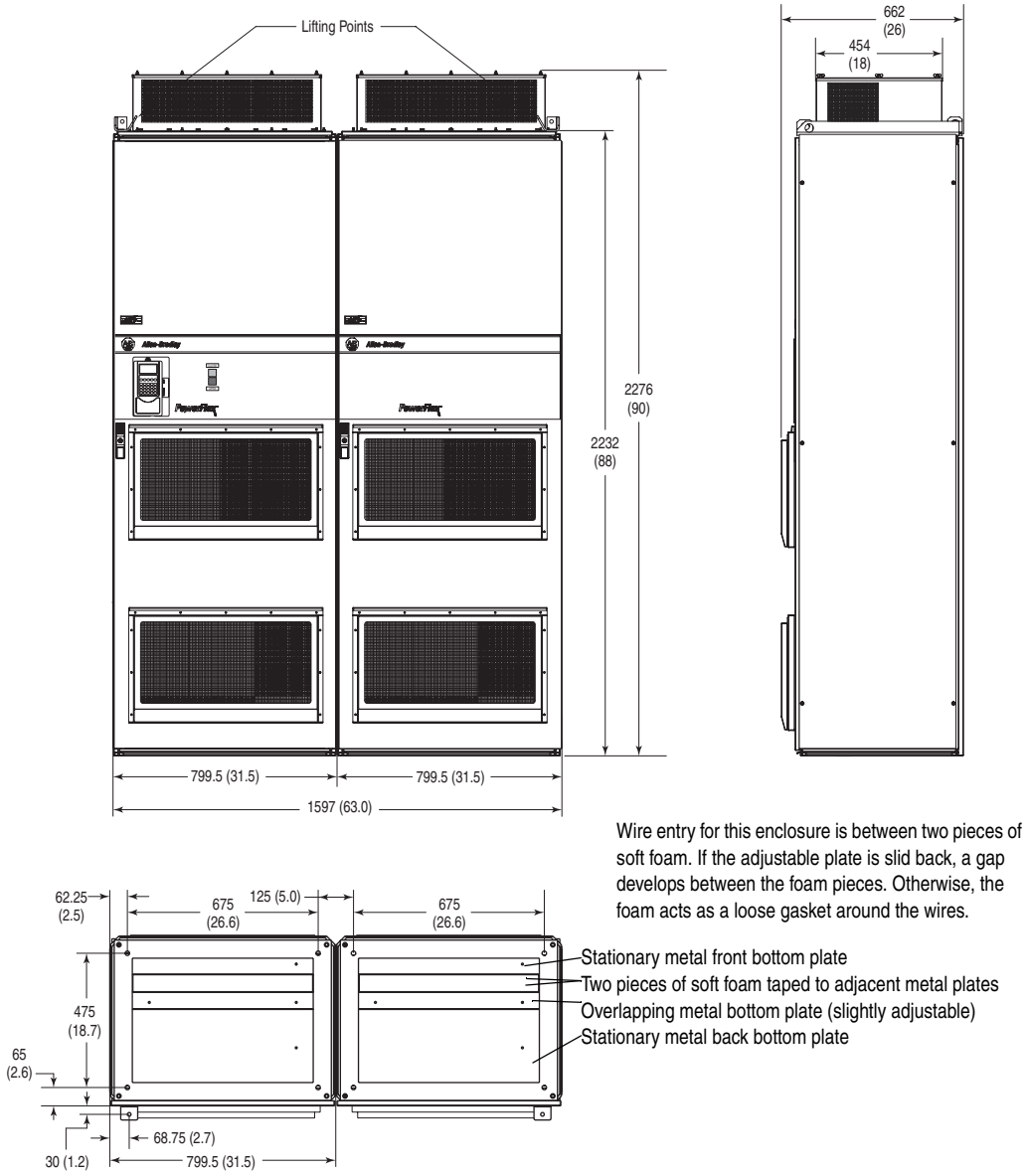


Wire entry for this enclosure is between two pieces of soft foam. If the adjustable plate is slid back, a gap develops between the foam pieces. Otherwise, the foam acts as a loose gasket around the wires.

Stationary metal front bottom plate
Two pieces of soft foam taped to adjacent metal plates
Overlapping metal bottom plate (slightly adjustable)
Stationary metal back bottom plate

Figure 11.6 DC Input Drive Enclosure Code H (NEMA/UL Type 12, IP54) and W (NEMA/UL Type 12, IP54 w/Conformal Coat)

Dimensions are in millimeters and (inches).



Lifting and Mounting Frame 14 Drives

Enclosed Frame 14 Drives with DC Input

Enclosed Frame 14 drives with DC input are shipped with the control pan mounted in the motor connection area of the left-hand enclosure. The control pan must be moved from this location to a location in the adjacent enclosure, away from the power connections.

Refer to Appendix B - Lifting and Mounting Instructions for detailed instructions on lifting and mounting the drive. When you have completed the instructions in Appendix B, continue with the installation as directed below.

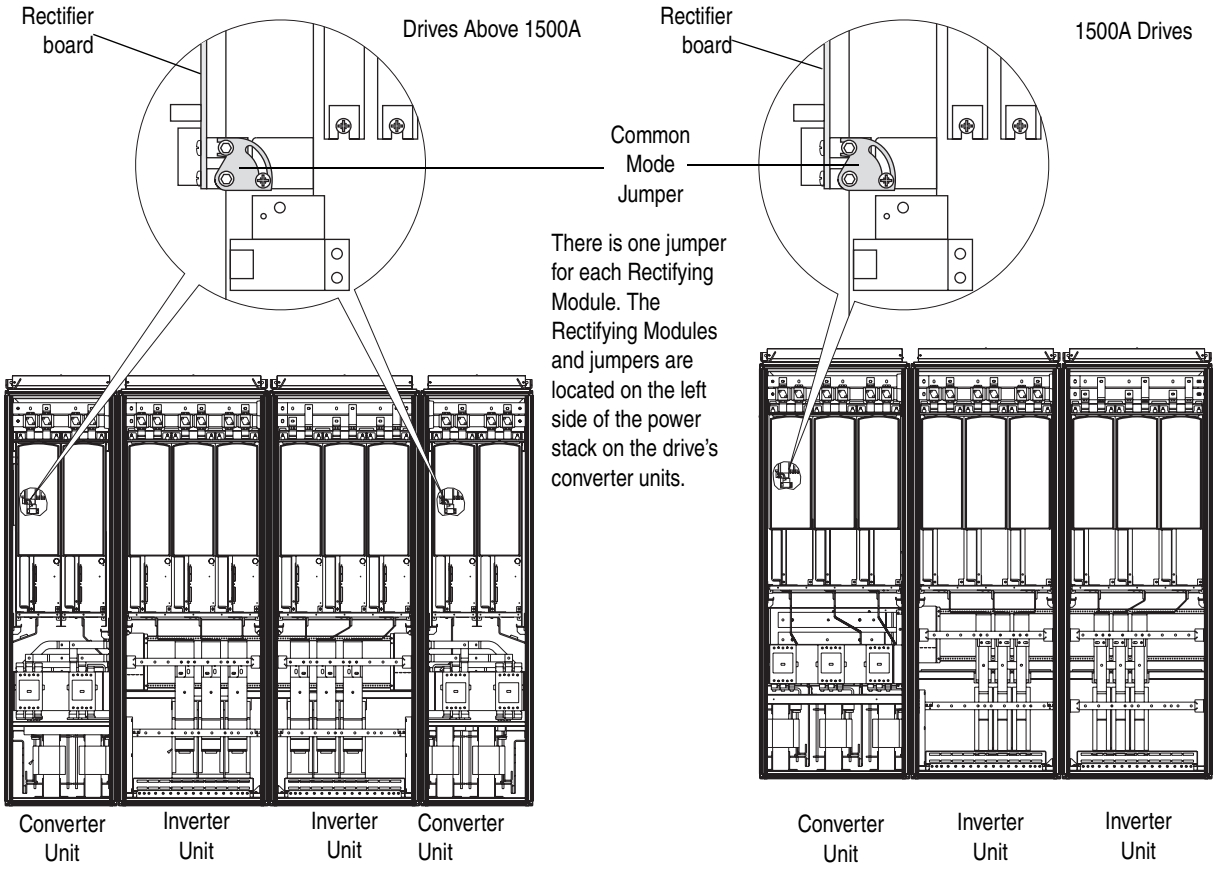
Ungrounded, High Resistive Ground or Grounded B Phase Delta Installations

Frame 14 size drives are equipped with common mode capacitors. To guard against drive damage, these capacitors should be disconnected depending upon the type of ground system on which the drive is installed.

To access and move the common mode jumper(s) and disconnect the capacitor connections you must first move the Control frame and remove the protective covers from the Converter unit. These steps are detailed on the following pages.

Note: Refer to *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives - Installation Instructions*, publication DRIVES-IN001…, for additional information on an ungrounded distribution system or high resistive ground installation.

Figure 11.7 Common Mode Jumper and Rectifier Circuit Board Location



Control Frame not shown for clarity only

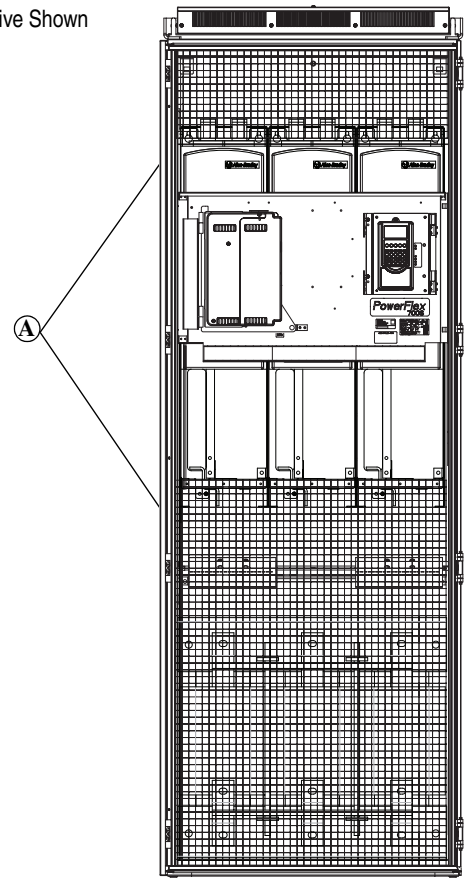
Removing the Protective Covers from the Converter Unit(s)

Removing the Protective Screens

To access the components within the Converter unit(s), you must first remove the protective screens from the drive.

Task	Description
Ⓐ	Remove the screws that secure the protective screens to the Converter unit(s) and remove the screens.

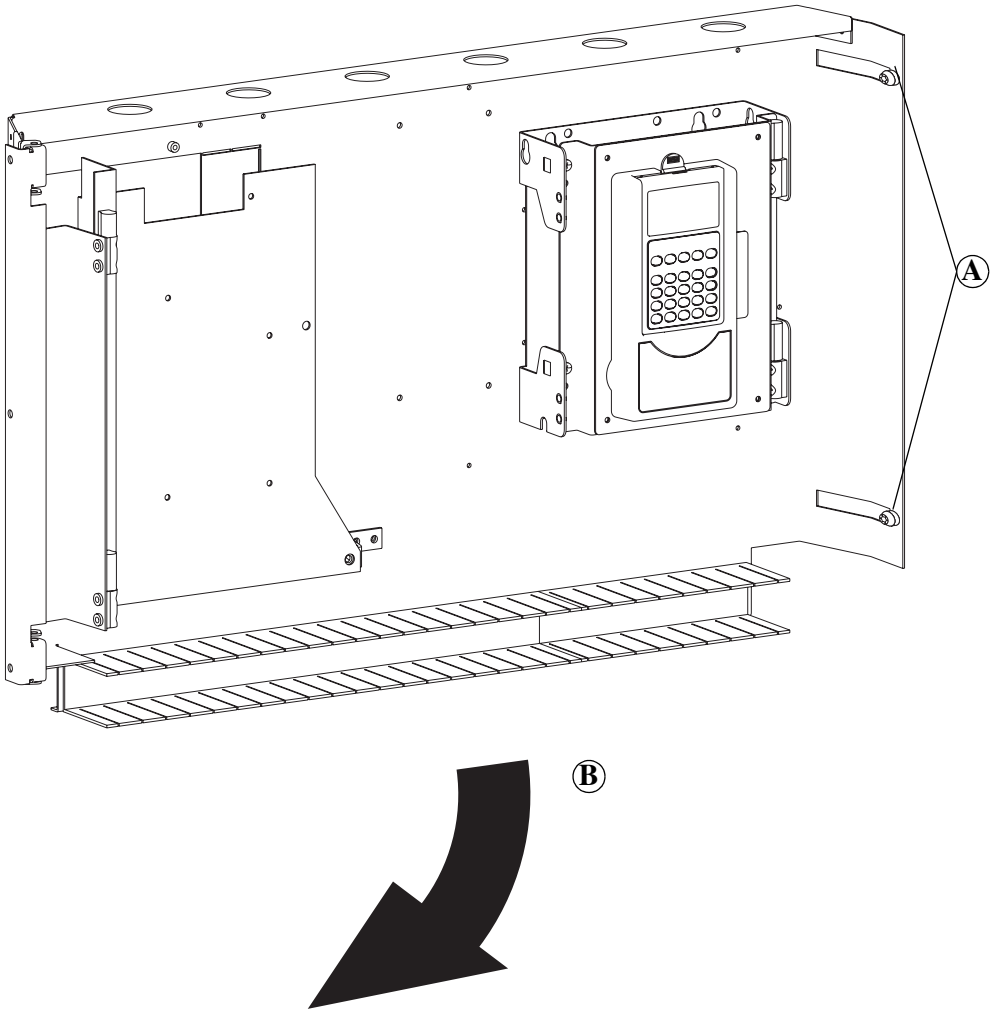
1500A Drive Shown



Moving the Control Frame

To gain access to the airflow plate and protective covers on the left side Converter unit of the drive you must move the Control Frame.

Task	Description
Ⓐ	Loosen the T8 Torx-head screws that secure the Control Frame to the drive enclosure.
Ⓑ	Swing the Control Frame out and away from the Converter unit.

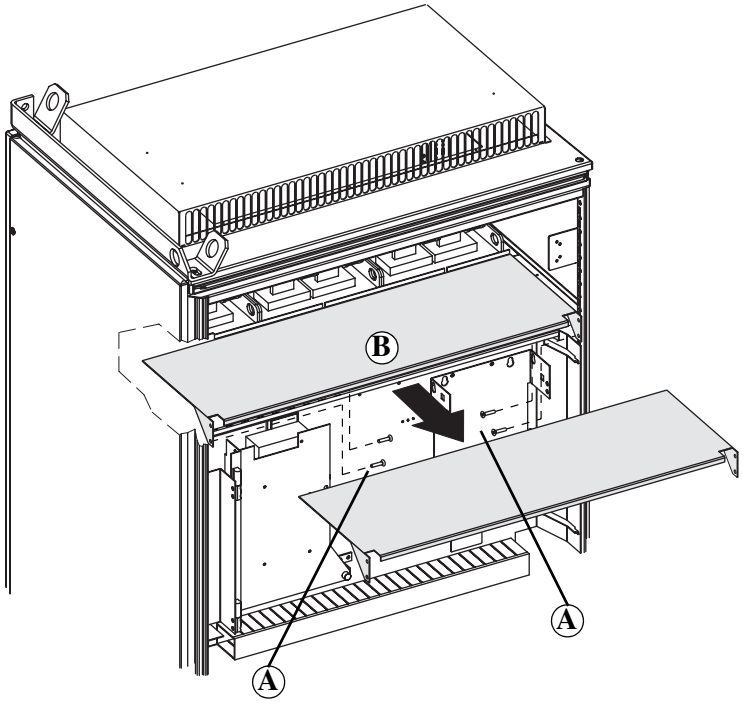


Removing the Airflow Plate(s)

The drive is equipped with a plate(s), just above the Converter unit(s), that directs airflow through the drive enclosure(s). You must remove this plate(s) in order to access the protective covers.

Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plate to the drive.
Ⓑ	Slide the airflow plate off of the drive.

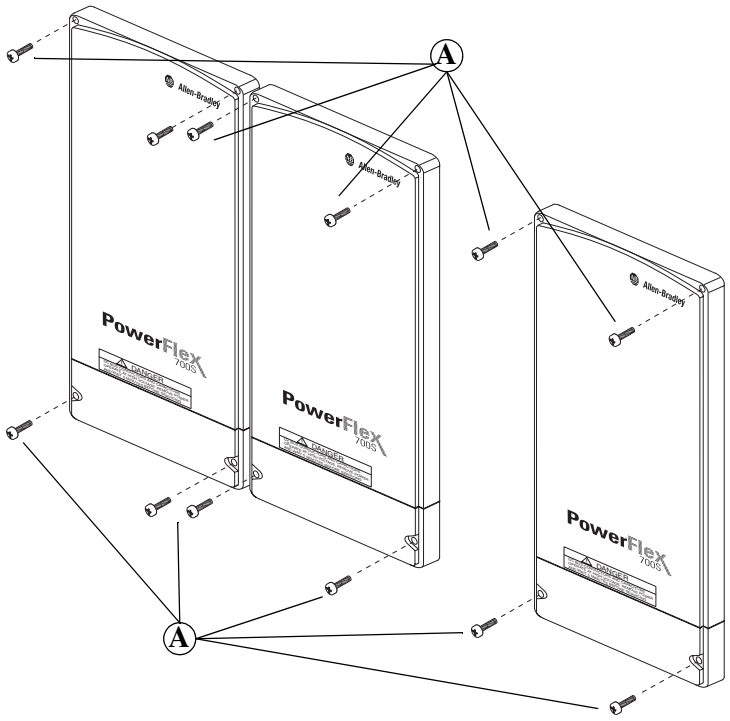
1500A Drive Shown



Removing the Protective Covers

You must remove the protective covers to gain access to the Converter unit(s).

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure each of the two or three main and bottom protective covers to the drive, then remove the protective covers.



Installation on an Ungrounded Distribution System or High Resistive Ground

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Should insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

If you are installing a **600/690V** AC input drive on an ungrounded distribution system or high resistive ground, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

Installation on a Grounded B Phase Delta System

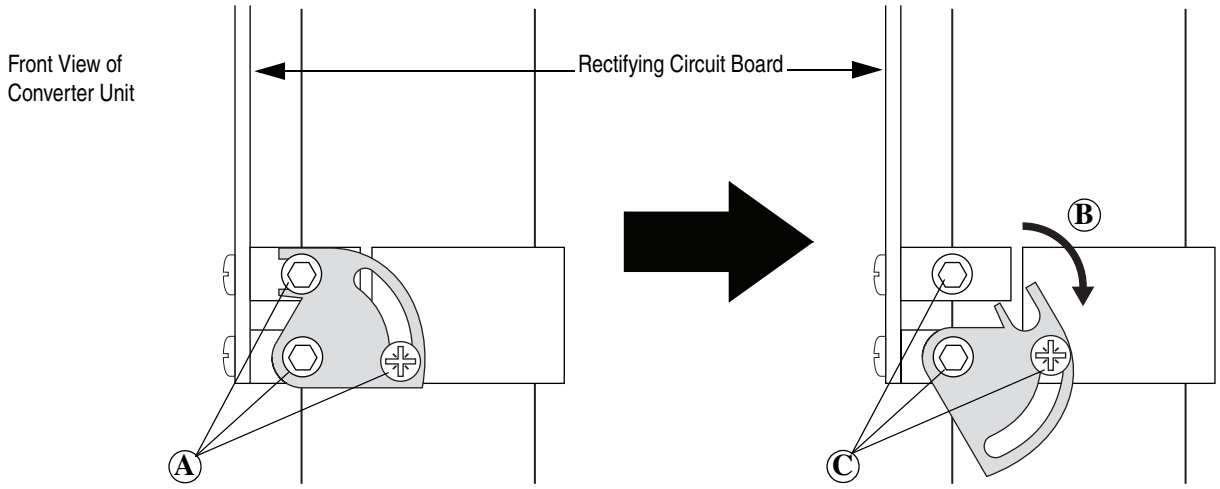
If you are installing a drive on a grounded B phase Delta system, you:

- Must move the common mode jumper(s) to the disconnected position - refer to "Move the Common Mode Jumper(s) to the Disconnected Position" on page 11-14.
- Must insulate terminal X4 on the Rectifier circuit board - refer to "Insulate Terminal X4 on the Rectifier Circuit Board" on page 11-15.

Move the Common Mode Jumper(s) to the Disconnected Position

Follow the lettered steps below to move the common mode jumper(s) to the disconnected position for each converter unit (refer to Figure 11.7 for MOV jumper location).:

Task	Description
Ⓐ	Loosen the screws and two fasteners that secure the jumper.
Ⓑ	Rotate the jumper to the lower position.
Ⓒ	Tighten the screw and two fasteners.

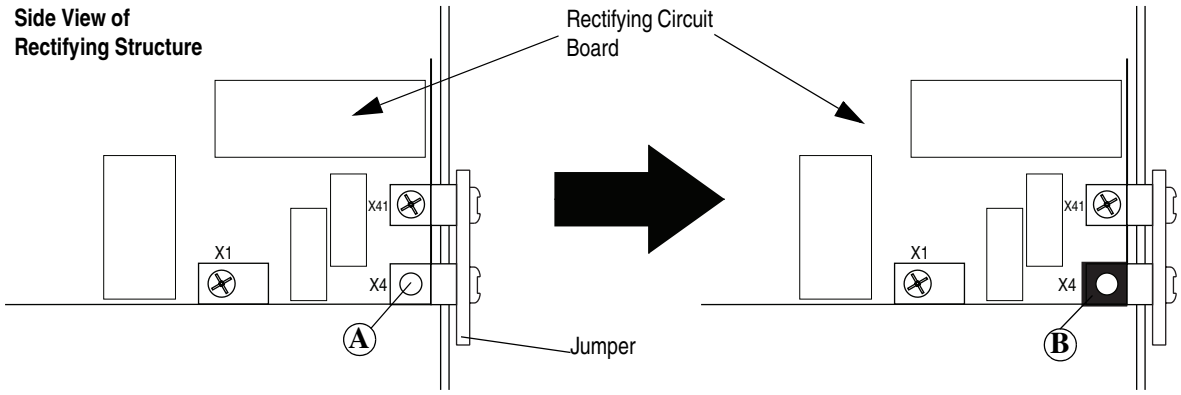


Insulate Terminal X4 on the Rectifier Circuit Board

Follow the lettered steps below to insulate terminal X4 on the Rectifier circuit board for each converter unit (refer to Figure 11.7 for Rectifier board location):

Task	Description
Ⓐ	Remove the screw from the X4 connection on the Rectifier circuit board.
Ⓑ	Insulate the top and bottom of the X4 connection on the Rectifier circuit board.

Important: Do not install the screw and washer that was removed from this connection.



Power Wiring

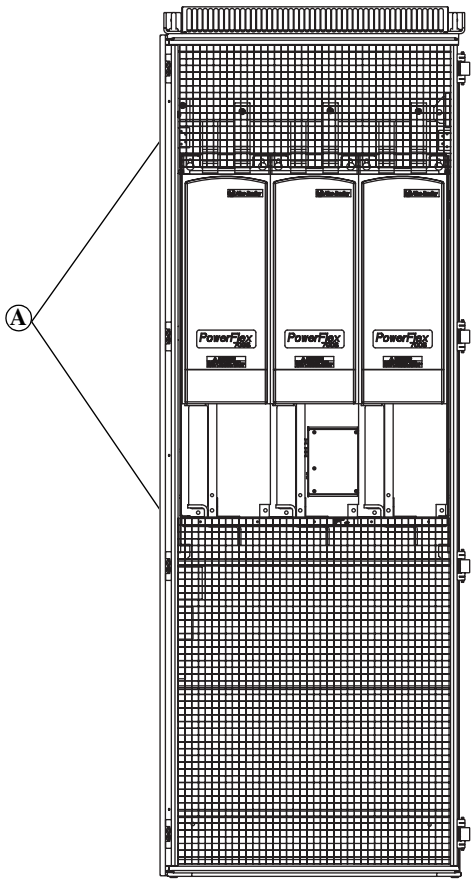
To access the power terminals, you must first remove the protective screens (on NEMA/UL Type 1 and Type 12 enclosures), air flow plate and protective covers from the Inverter units. These steps are detailed below.

Removing the Protective Covers from the Inverter Units

Removing the Protective Screens

To access the components within the Power Structures, you must first remove the protective screens from the Inverter units.

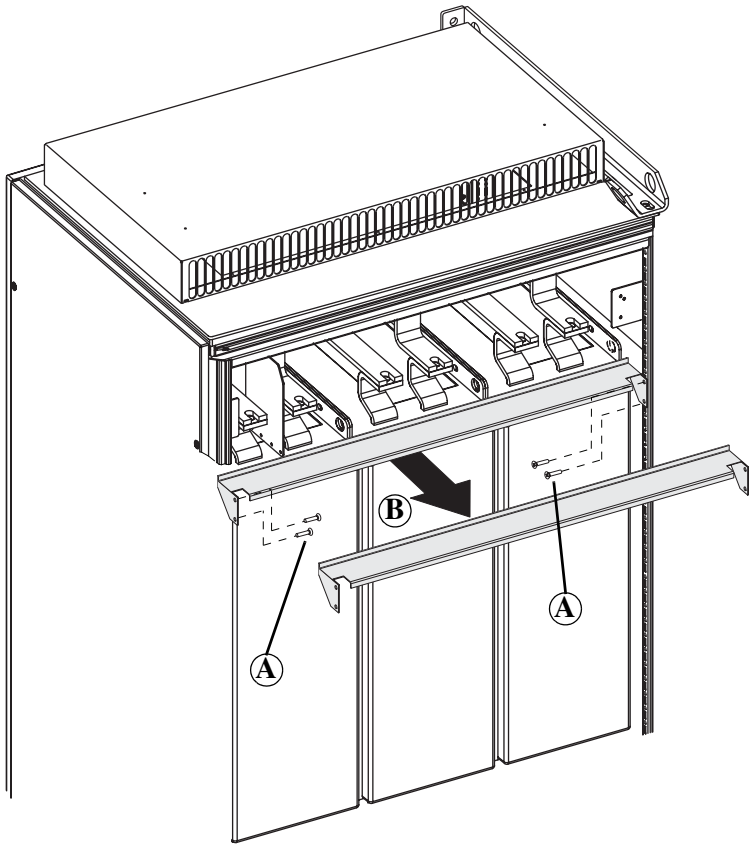
Task	Description
Ⓐ	Remove the screws that secure the protective screens to the inverter units and remove the screens.



Removing the Airflow Plates

The drive is equipped with plates, just above the top of the protective covers, that direct airflow through the drive enclosure. You must remove these plates in order to access the protective covers.

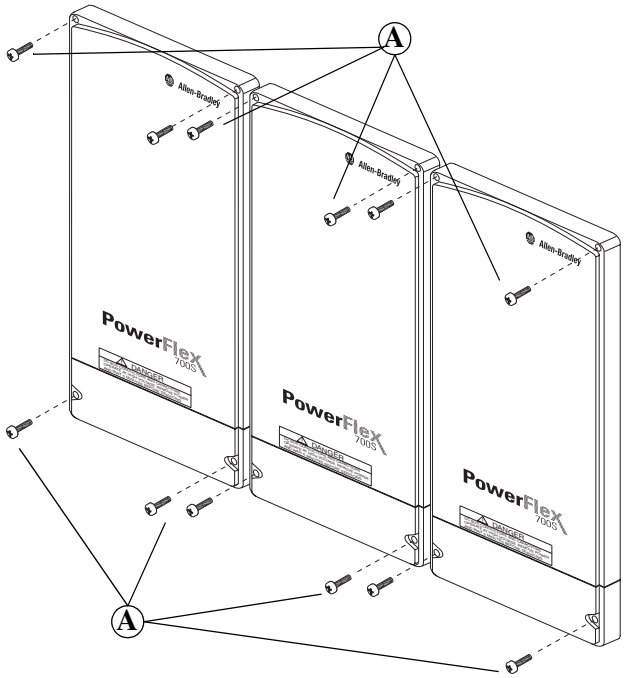
Task	Description
Ⓐ	Remove the T8 Torx-head screws that secure the airflow plates to the drive.
Ⓑ	Slide the airflow plates off of the drive.



Removing the Protective Covers

You must remove the protective covers from the Inverter units in order to gain access to the power terminals.

Task	Description
Ⓐ	Remove the four M5 POZIDRIV screws that secure each of the three main and bottom protective covers to the drive, then remove the protective covers.



400 and 690 Volt Class AC Input Wiring for Frame 14 Drives

Frame 14 size drives utilize three parallel converter units or two pairs of two parallel converter units that are pre-connected to line reactors and are fed through motor operated circuit breakers.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Frame 14 drives can be ordered with or without du/dt filters. The du/dt filter limits the rate of change of output voltage and the rate of change in the IGBT or output transistor switching event.

Refer to the *Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives*, publication DRIVES-IN001…, for minimum inductance on installations where du/dt filters are not installed.

Figure 11.8 1500A Drive AC Wiring Example:

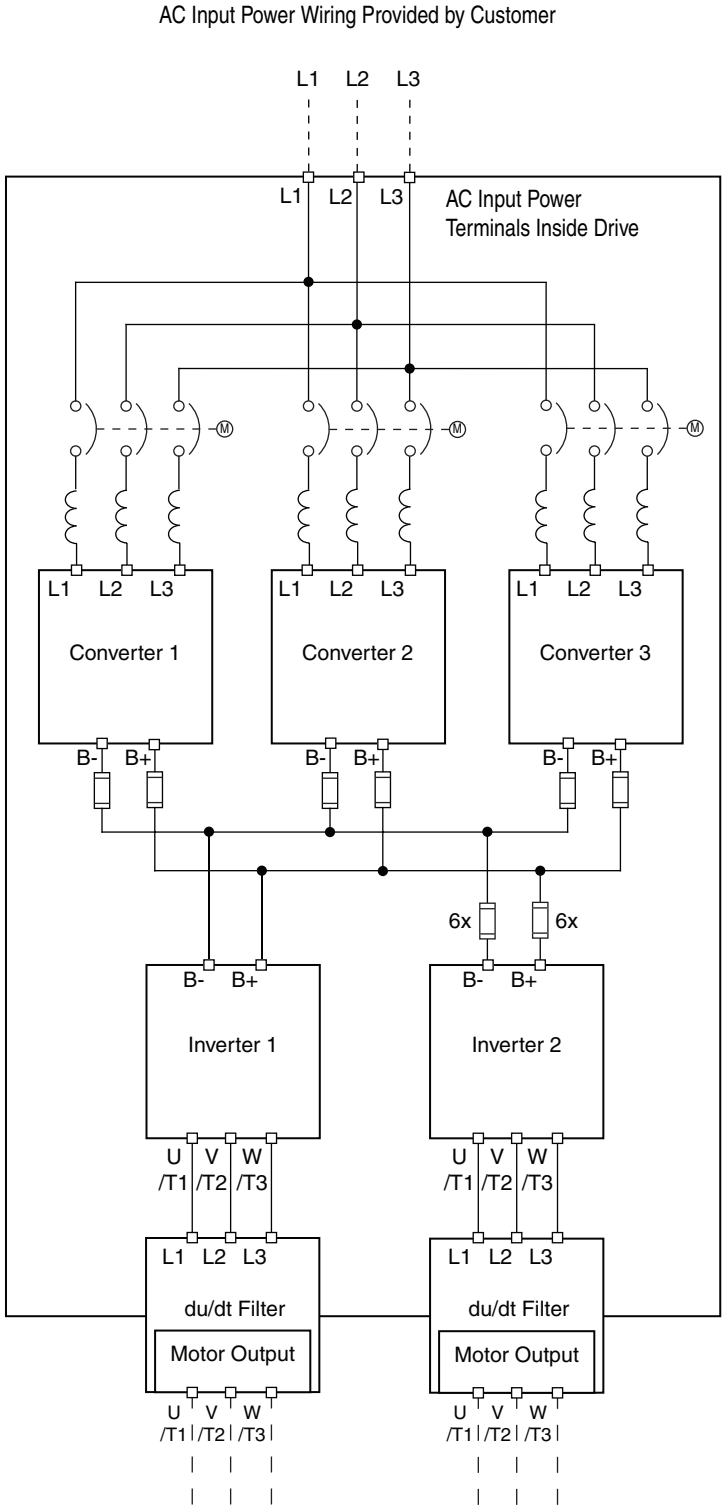
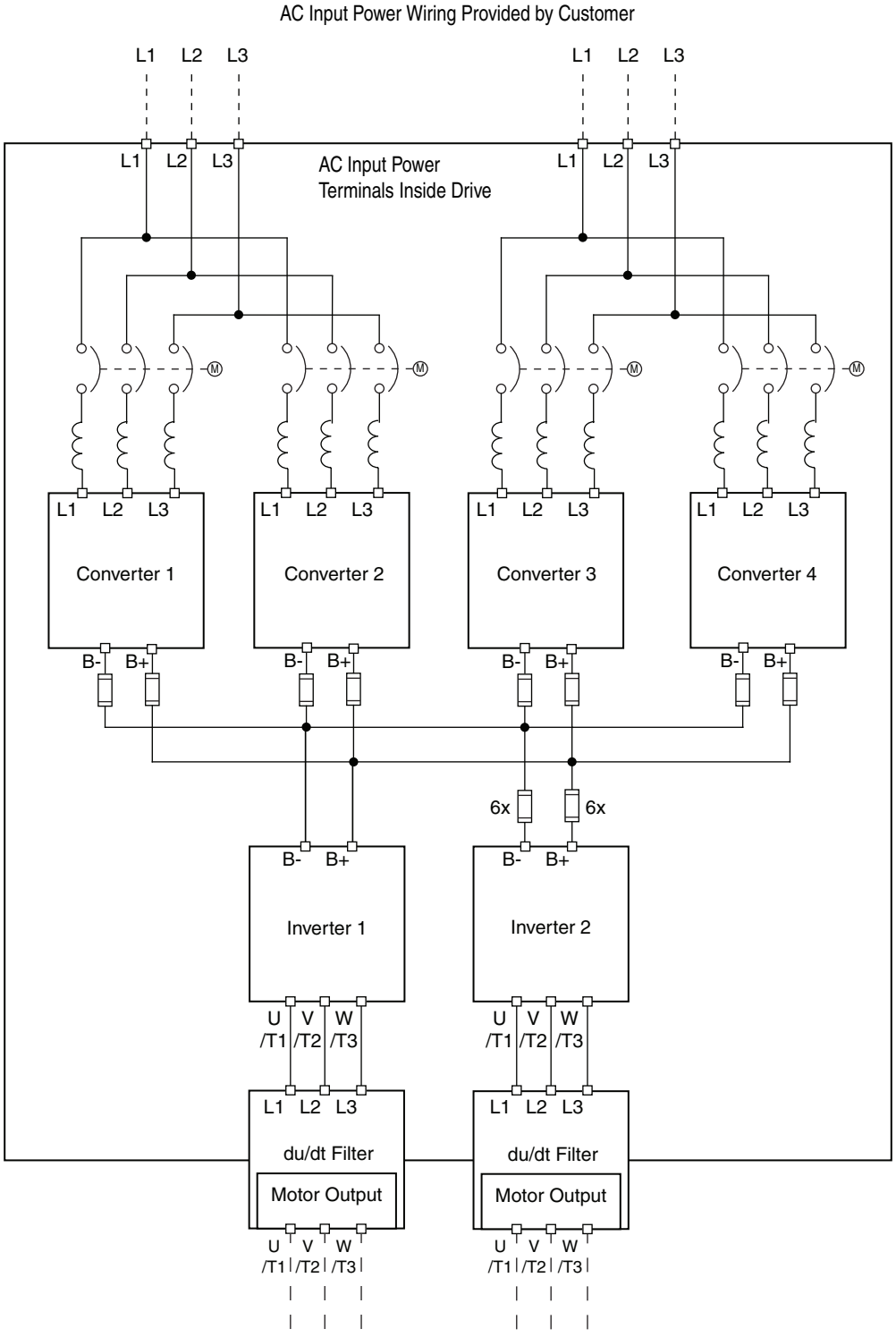


Figure 11.9 Drives Above 1500A AC Wiring Example:



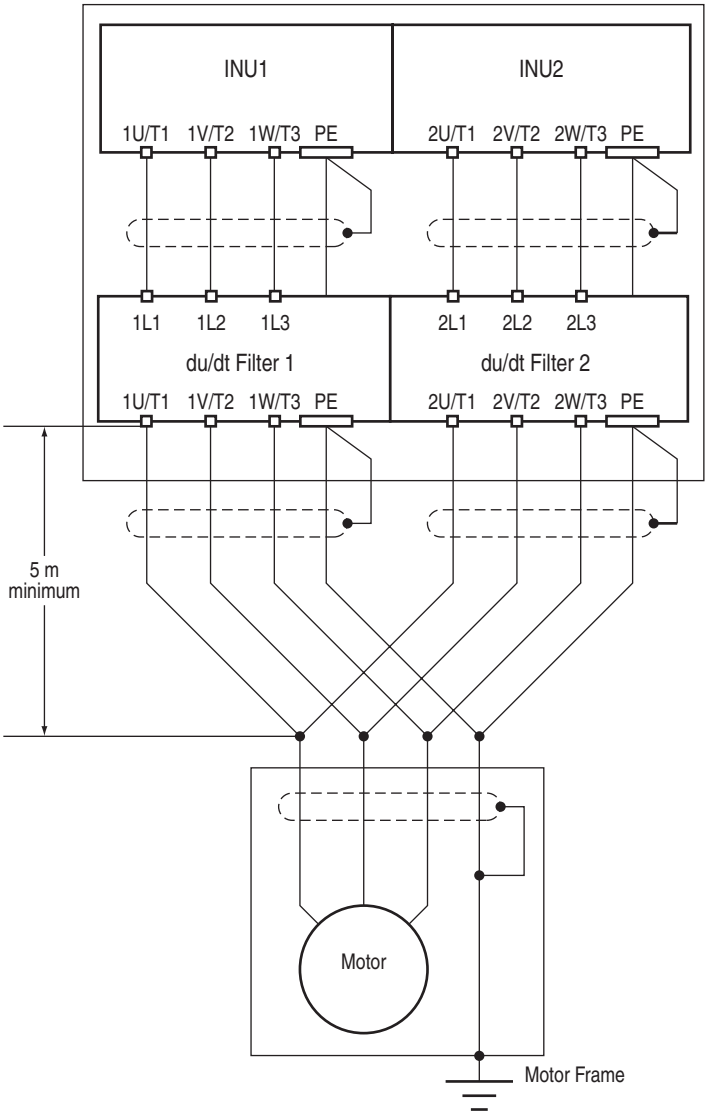
Output Power Wiring for Frame 14 Drives

Frame 14 drives utilize two parallel power structures, and therefore have two sets of output power terminals. You must connect the motor to both sets of output power terminals.

Important: Parallel wiring must have the same cable dimensions, type and routing. Non-symmetrical wiring may cause unequal loading between the converters and reduce the drive's ability to deliver current to the motor.

Important: The minimum cable length for parallel motor cables from the drive to the point where the cables connect is 5m (16.4 ft.). Join the parallel cables at the motor end (not the drive end). Or, install a reactor on the output of each power module with a minimum of 5 µH prior to joining the parallel cables at the motor end.

Figure 11.8 Motor Wiring Example



Important: Once power wiring has been completed, the protective covers must be installed before energizing the drive. Installation is in reverse order of removal (refer to "Removing the Protective Covers from the Converter Unit(s)" on page 11-10 and "Removing the Protective Covers from the Inverter Units" on page 11-16.)

Table 11.B Power Terminal Specifications

No.	Name	Description	Wire Size Range (1)(2)		Torque	Terminal Bolt Size (3)(4)
			Maximum	Minimum	Recommended	
❶	Input Power Terminal Block (1) L1, L2, L3	Input power	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❷	Output Power Terminal Block (3) U/T1, V/T2, W/T3	Motor connections	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12
❸	SHLD Terminal, PE, Motor Ground (3)	Terminating point for wiring shields	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M10
❹	DC Bus (3) (3 Terminals; DC–, DC+)	DC input or external brake	300 mm^2 (600 MCM)	2.1 mm^2 (14 AWG)	40 N•m (354 lb•in)	M12

(1) Maximum/minimum sizes that the terminal block will accept - these are not recommendations.
(2) Do Not exceed maximum wire size. Parallel connections may be required.
(3) These connections are bus bar type terminations and require the use of lug type connectors.
(4) Apply counter torque to the nut on the other side of terminations when tightening or loosening the terminal bolt in order to avoid damage to the terminal.

Figure 11.10 1500A Drive Terminal Locations

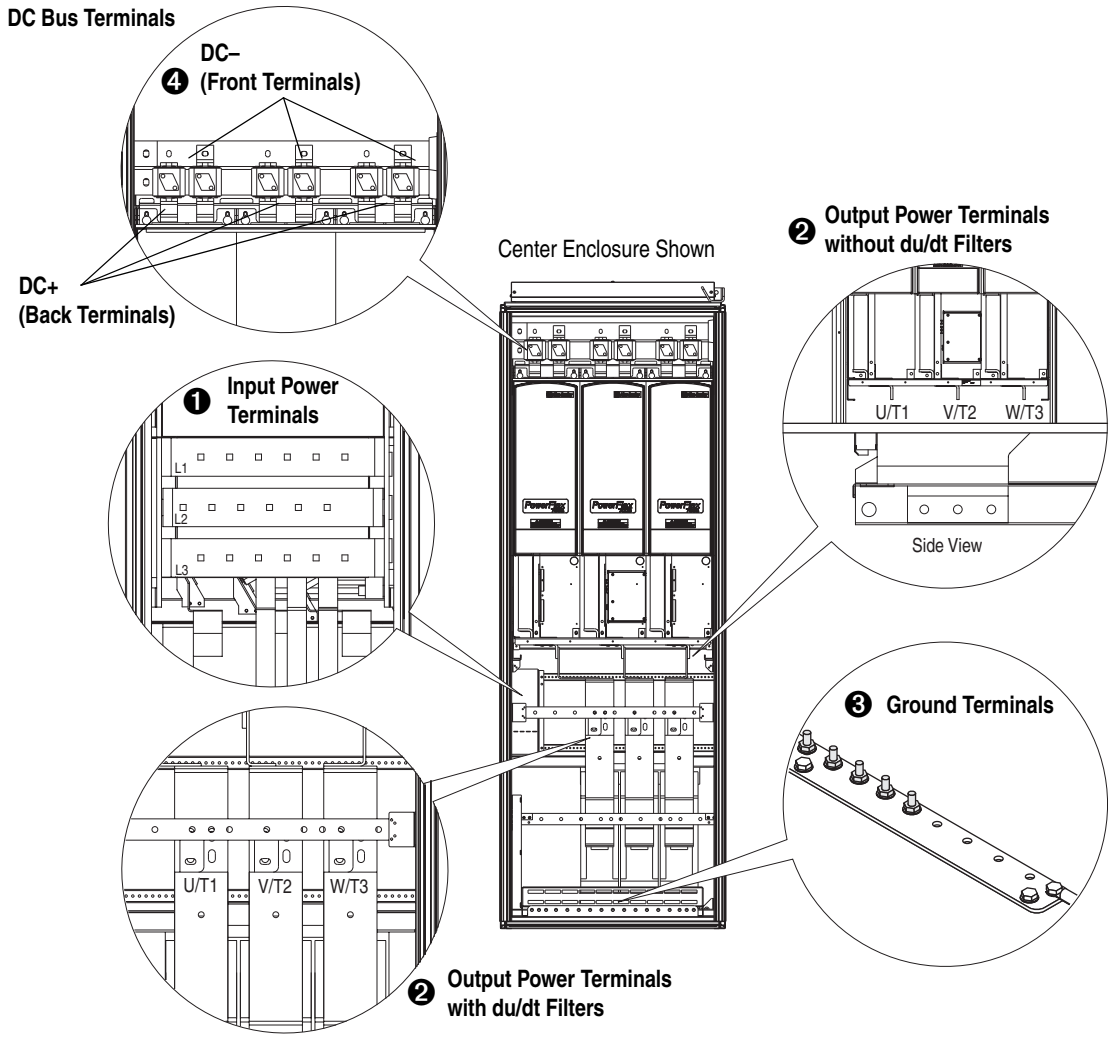
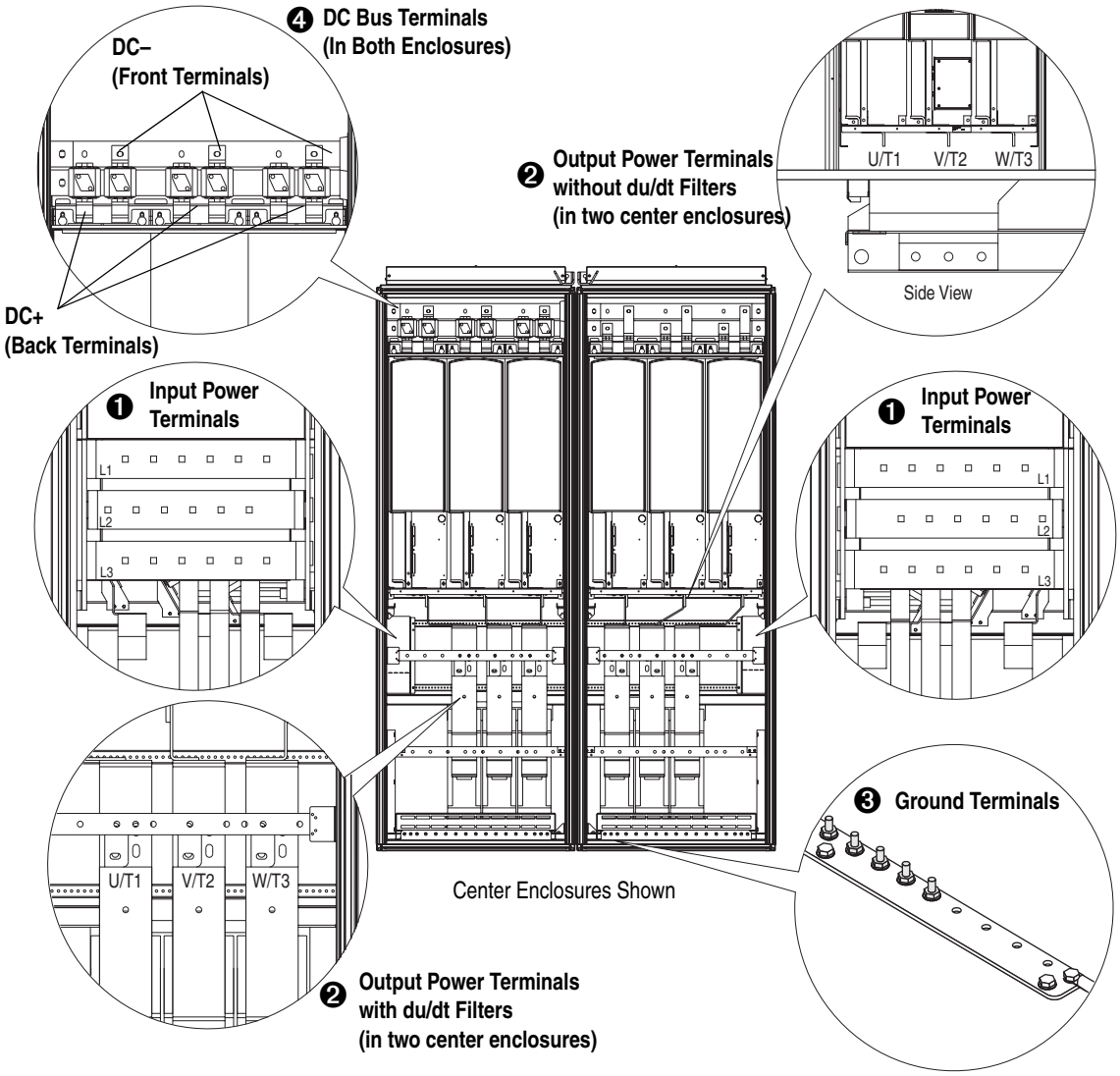
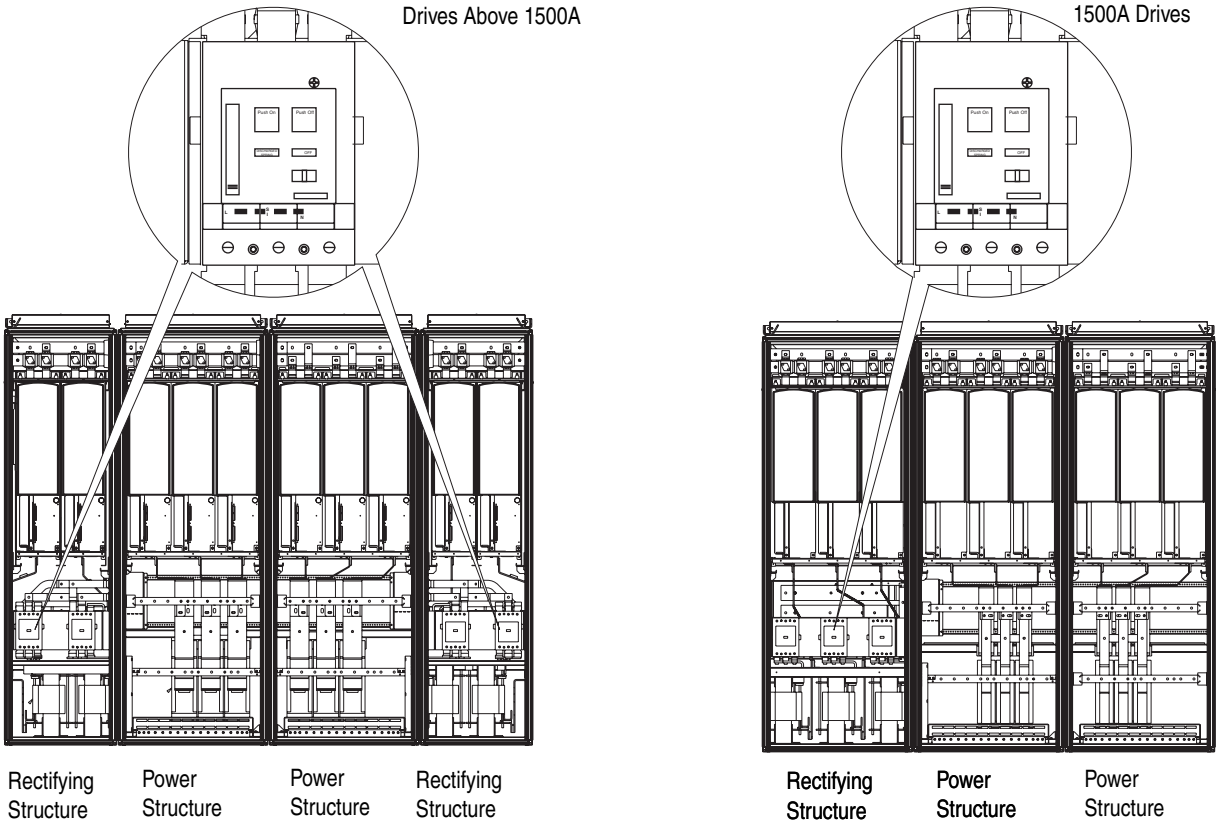


Figure 11.11 Drives Above 1500A Terminal Locations



Frame 14 Circuit Breakers

Frame 14 drives utilize molded case circuit breakers (MCCBs) to provide overload/overcurrent and undervoltage protection on the incoming AC lines and to synchronize the energizing of the power structures. The circuit breakers are located inside of the enclosures in front of the AC Chokes.



Note: Control Frame not shown for clarity only.

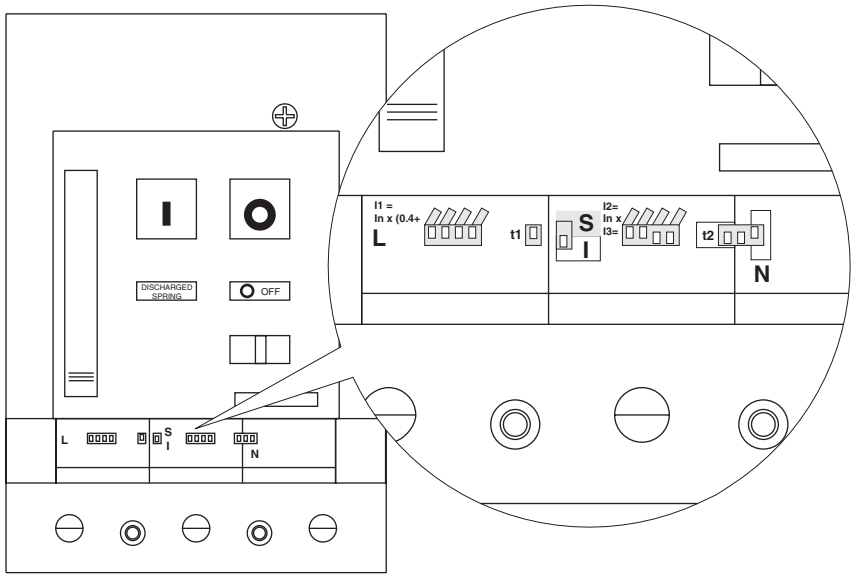
Circuit Breaker DIP Switch Settings

The DIP switches on the circuit breakers are configured to the correct settings at the factory. However, the settings detailed in Table 11.C below should be verified before charging the circuit breaker motor operators and operating the drive.

Table 11.C Circuit Breaker DIP Switch Settings

Voltage Class	Drive ND Cont. Amp Rating	L		S/I			N	
		I1	t1	S/I	I3	t2	ON/OFF	50% / 100%
400/480V AC	1770	0.76	3 s	S	1.5	0.1 s	OFF	na
	2150	0.92	3 s	S	1.5	0.1 s	OFF	na
600/690V AC	1500	0.88	3 s	S	1.0	0.1 s	OFF	na
	1900	0.84	3 s	S	1.0	0.1 s	OFF	na
	2250	0.96	3 s	S	1.5	0.1 s	OFF	na

Figure 11.12 Circuit Breaker DIP Switches Location

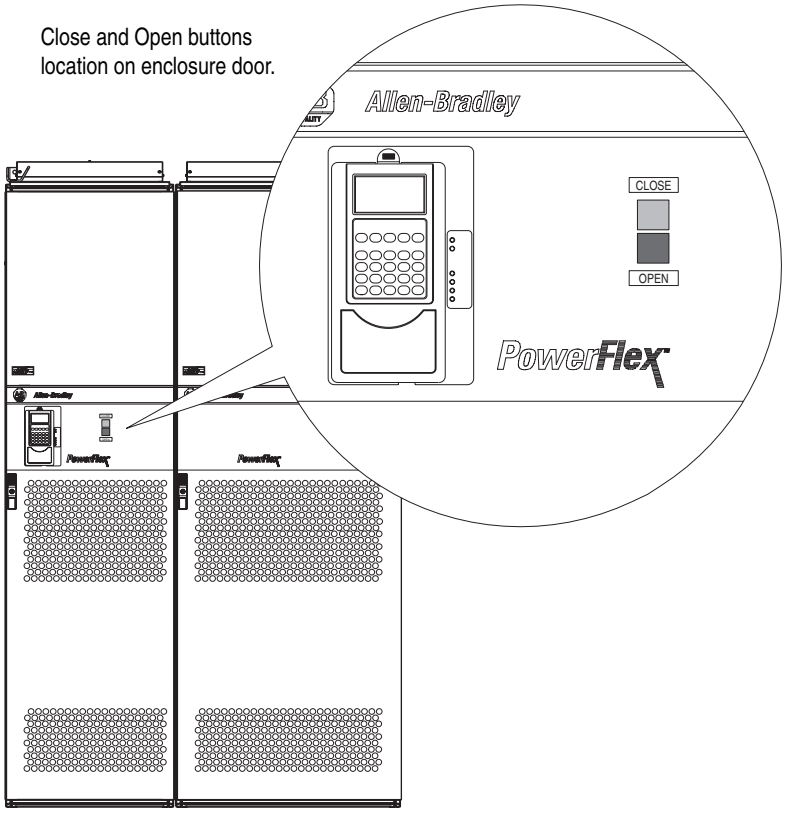


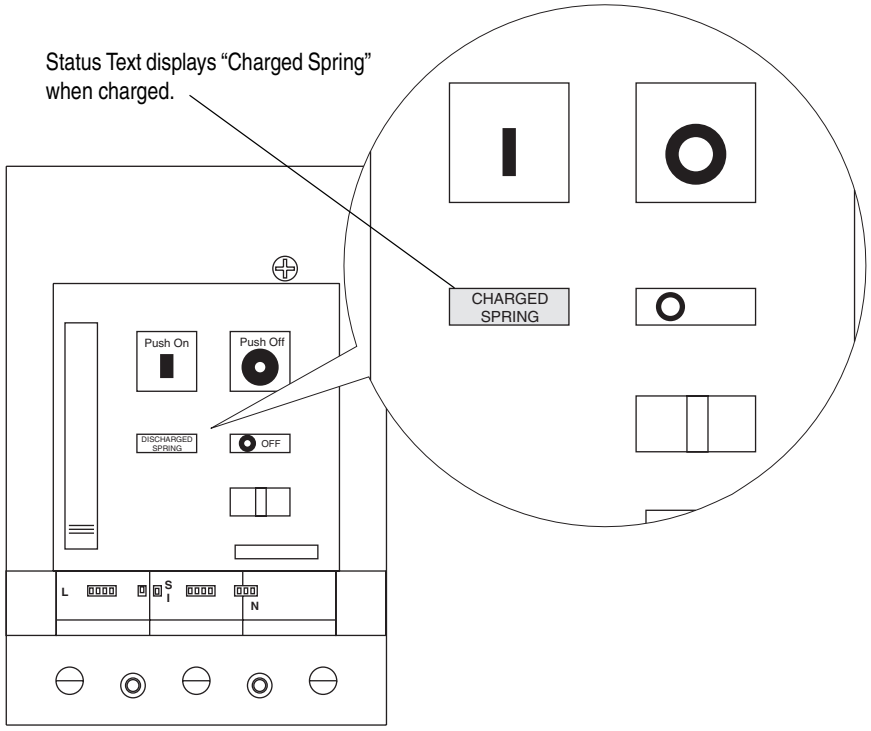
Charging the MCCB Motor Operators

The stored energy motor operators must be charged prior to the first time the circuit breakers are closed and whenever input power is removed and re-applied to the drive.

ATTENTION: When an external device for circuit breaker motor operator status is not used, the enclosure door(s) must be open in order to view the status indicator on the circuit breakers. Only qualified personnel familiar with PowerFlex 700S and 700H drives and associated machinery should plan or implement the installation, start-up and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

1. With the doors of the enclosures containing the MCCBs open, apply control voltage to the drive.
2. Press and hold the “Open” (red) control button on the enclosure door until the status text “Charged Spring” displays on each of the MCCBs (see illustration below).





3. The MCCBs can now be closed (see "Closing the Circuit Breakers and Energizing the Drive" on page 11-27).

Closing the Circuit Breakers and Energizing the Drive

1. Close and latch all enclosure doors.
2. Press the “Close” (green) control button on the enclosure door.
3. The circuit breakers can be opened by pressing the “Open” (red) control button on the enclosure door.

The motor operators are automatically recharged when they are opened.

Resetting the Circuit Breakers

The electronic trip unit will open the circuit breaker in the case of a drive overload/overcurrent condition. When a voltage drop (U < 0.7 x Un) or loss of the main supply occurs, the undervoltage release coil of the circuit breakers will open. The trip indicator contacts of the circuit breakers are connected in series. Therefore, if one circuit breakers trips due to an undervoltage or overload/overcurrent condition, all circuit breakers will open/trip.

If the circuit breakers have opened due to an overcurrent fault, the condition that caused the fault must be corrected and the fault cleared before the circuit breakers can be reset and the drive started. In this case, refer to "Charging the MCCB Motor Operators" on page 11-26.

Specifications

Category		PowerFlex 700H	PowerFlex 700S
Agency Certification		Listed to UL508C and CAN/CSA-C2.2 No. 14-M91.	UL and cUL Listed to UL508C and CAN/CSA - 22.2 No. 14-95.
		Marked for all applicable European Directives(1) EMC Directive (89/336/EEC) EN 61800-3 Adjustable Speed electrical power drive systems Low Voltage Directive (73/23/EEC) EN 50178 Electronic Equipment for use in Power Installations	Marked for all applicable European Directives EMC Directive (89/336/EEC) Emissions: EN 61800-3 Adjustable Speed electrical power drive systems Part 3 Low Voltage Directive (73/23/EEC) EN 50178 Electronic Equipment for use in Power Installations
	 N223	Certified to AS/NZS, 1997 Group 1, Class A.	Certified to AS/NZS, 1997 Group 1, Class A.
	 II 2 G/D	Certified to ATEX directive 94/9/EC. Group II Category (2) GD Applications with ATEX Approved Motors. Refer to Appendix E - Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors for more information.	Certified to ATEX directive 94/9/EC. Group II Category (2) GD Applications with ATEX Approved Motors. PowerFlex 700S Phase II Control drives only. Refer to publication 20D-UM006… for more information.
		NA	TUV functional safety report only (no FS mark on the label)
		The drive is also designed to meet the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 7.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. IEC 146 - International Electrical Code.	The drive is designed to meet applicable requirements of the following codes/standards: IEC 61800-2 Adjustable speed electrical power drive systems - General requirements IEC 61800-5-1 Adjustable speed electrical power drive systems - Safety requirements NFPA 70 - US National Electrical Code

(1) Applied noise impulses may be counted in addition to the standard pulse train causing erroneously high [Pulse Freq] readings.

Category	Specification	PowerFlex 700H					PowerFlex 700S				
Protection	**Drive**	**380/400V**	**480V**	**500V**	**600V**	**690V**	**380/400V**	**480V**	**500V**	**600V**	**690V**
	AC Input Overvoltage Trip:	611Vac	611Vac	611Vac	806Vac	806Vac	675Vac	675Vac	675Vac	889Vac	889Vac
	AC Input Undervoltage Trip:	235Vac	235Vac	235Vac	326Vac	326Vac	Adjustable				
	Bus Overvoltage Trip:	911Vdc	911Vdc	911V dc	1200V dc	1200V dc	911Vdc	911Vdc	911Vdc	1200Vdc	1200Vdc
	Bus Undervoltage Shutoff/Fault:	333Vdc	333Vdc	333Vdc	461Vdc	461Vdc	Adjustable				
	Nominal Bus Voltage (Full Load):	517Vdc	621Vdc	645Vdc	776Vdc	890Vdc	540Vdc	648Vdc	645Vdc	810Vdc	931V dc
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip					Monitored by microprocessor overtemp trip				
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip: Instantaneous Current Limit:	— 360% of rated Heavy Duty current (typical) —					Calculated value, 105% of motor rated to 200% of drive rated 360% of rated Heavy Duty current (typical) —				
	Line transients:	up to 6000 volts peak per IEEE C62.41-1991					Up to 6000 volts peak per IEEE C62.41-1991				
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak					Showering arc transients up to 1500V peak				
	Power Ride-Thru:	15 milliseconds at full load					15 milliseconds at full load				
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical					0.25 seconds, drive not running				
	Ground Fault Trip:	Phase-to-ground on drive output					Phase-to-ground on drive output				
	Short Circuit Trip:	Phase-to-phase on drive output					Phase-to-phase on drive output				

Category	Specification	PowerFlex 700H				PowerFlex 700S			
Environment	Altitude:	1000 m (3300 ft.) maximum without derating. Derate the drive by 1% for every 100 m (328 ft.) above 1000 m (3300 ft.).				1000 m (3300 ft.) maximum without derating. Derate the drive by 1% for every 100 m (328 ft.) above 1000 m (3300 ft.).			
	Maximum Surrounding Air Temperature without De-rating:	Based on drive rating, refer to Drive Frame chapters				Based on drive rating, refer to Drive Frame chapters.			
	Storage Temperature (all const.):	–40 to 60° C (–40 to 140° F)				–40 to 70° C (–40 to 158° F)			
	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.				**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.			
	Relative Humidity:	5 to 95% non-condensing				5 to 95% non-condensing			
	Shock: Non-operational	15G peak for 11ms duration (±1.0 ms)				15G peak for 11ms duration (±1.0 ms)			
	Vibration:	2 mm (0.0787 in.) displacement, 1G peak EN50178 / EN60068-2-6				2 mm (0.0787 in.) displacement, 1G peak EN50178 / EN60068-2-6			
	Sound:	Frame	Sound Level	Back-ground Noise Level	**Note**: Sound pressure level is measured at 1 meter. All devices measured are 400V IP21 and in power up mode.	Frame	Sound Level	Back-ground Noise Level	**Note**: Sound pressure level is measured at 1 meter. All devices measured are 400V IP21 and in power up mode.
		9	78 dba	49 dba		9	78 dba	49 dba	
		10	77 dba	49 dba		10	77 dba	49 dba	
		13	76d ba	46 dba		13	76d ba	46 dba	
Electrical	AC Input Voltage Tolerance:	±10%				±10%			
	Frequency Tolerance:	47-63 Hz.				47-63 Hz.			
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.				Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.			
	Displacement Power Factor:	0.98 across entire speed range.				0.98 across entire speed range.			
	Efficiency:	97.5% at rated amps, nominal line volts.				97.5% at rated amps, nominal line volts.			
	Maximum Short Circuit Rating:	≤200,000 Amps symmetrical.				≤200,000 Amps symmetrical.			
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker.				Determined by AIC rating of installed fuse/circuit breaker.			
	Maximum Drive to Motor Power Ratio:	Recommended not greater than 2:1 ratio.				Drive to motor rating cannot exceed a 2:1 ratio.			

Category	Specification	PowerFlex 700H	PowerFlex 700S
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex Reference Manual). The drive can be supplied as 6 pulse or 12 pulse in a configured package.	Sine coded PWM with programmable carrier frequency, Indirect Self-Organized, Field-Oriented Control, Current-regulated. Ratings apply to all drives (refer to the *Derating Guidelines* in the PowerFlex 700S Phase II Reference Manual, publication PFLEX-RM003...). The drive can be supplied as 6 pulse or 12 pulse in a configured package.
	Carrier Frequency:	1-6 kHz.	2 kHz Settings: 2, 4, 6, 8, 10 kHz (6 kHz is for V/Hz operation only)
	Output Voltage Range:	0 to rated motor voltage	0 to rated motor voltage
	Output Frequency Range:	0 to 320 Hz	0 to 400 Hz Note: For output frequencies above 320 - 400 Hz consult the factory.
	Frequency Accuracy Digital Input: Analog Input:	 Within ±0.01% of set output frequency. Within ±0.4% of maximum output frequency.	–
	Frequency Control:	Speed regulation - with Slip Compensation 0.5% of base speed across 40:1 speed range 40:1 operating range	–
	Speed Control:		Speed regulation - without feedback 0.1% of base speed across 120:1 speed range 120:1 operating range 50 rad/sec bandwidth
			Speed regulation - with feedback 0.001% of base speed across 120:1 speed range 1000:1 operating range 300 rad/sec bandwidth
	Torque Regulation:		Torque Regulation - without feedback ±10%, 600 rad/sec bandwidth
			Torque Regulation - with feedback ±5%, 2500 rad/sec bandwidth
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability.	Field Oriented Control with and without a feedback device and permanent magnet motor control
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.	Multiple programmable stop modes including - Ramp, Coast and Current Limit.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0 to 3276.7 seconds in 0.1 second increments.	Two independently programmable accel and decel times. Each time may be programmed from 0 - 6553.5 seconds in 0.1 second increments.
	S-Curve Time:	0-100% of accel/decel time.	Adjustable from 0.5 to 4.0 seconds.
	Intermittent Overload:	110% Overload capability for up to 1 minute 150% Overload capability for up to 2 seconds	110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability:	Proactive Current Limit programmable from 20 to 160% of rated output current. Programmable proportional gain.	Independent Motoring and Regenerating Power Limits programmable to 800% of rated output current
	Electronic Motor Overload Protection:	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

<table>
<tr><th>Category</th><th>Specification</th><th>PowerFlex 700H</th><th>PowerFlex 700S</th></tr>
<tr><td>Feedback</td><td>Encoder Inputs (2):</td><td></td><td>Dual Channel Plus Marker, Isolated with differential transmitter Output (Line Drive) Incremental, Dual Channel Quadrature type</td></tr>
<tr><td></td><td>Encoder Voltage Supply:</td><td></td><td>5V DC or 12 V DC 320 mA/channel
5V DC minimum high state voltage of 3.0V DC, maximum low state voltage at 0.4V DC
12 V DC minimum high state voltage of 7.0V DC, maximum low state voltage of 0.4V DC</td></tr>
<tr><td></td><td>Encoder PPR Rating:</td><td></td><td>Encoder PPR ratings are limited to the values specified in the table below:
<table>
<tr><th>n =</th><th>2^n =</th><th>x</th><th>mod 75</th><th>mod 125</th><th>mod 225</th><th>mod 375</th><th>mod 625</th><th>mod1125</th></tr>
<tr><td>0</td><td>1</td><td></td><td>75</td><td>125</td><td>225</td><td>375</td><td>625</td><td>1125</td></tr>
<tr><td>1</td><td>2</td><td></td><td>150</td><td>250</td><td>450</td><td>750</td><td>1250</td><td>2250</td></tr>
<tr><td>2</td><td>4</td><td></td><td>300</td><td>500</td><td>900</td><td>1500</td><td>2500</td><td>4500</td></tr>
<tr><td>3</td><td>8</td><td></td><td>600</td><td>1000</td><td>1800</td><td>3000</td><td>5000</td><td>9000</td></tr>
<tr><td>4</td><td>16</td><td></td><td>1200</td><td>2000</td><td>3600</td><td>6000</td><td>10000</td><td>18000</td></tr>
<tr><td>5</td><td>32</td><td></td><td>2400</td><td>4000</td><td>7200</td><td>12000</td><td>20000</td><td>--</td></tr>
<tr><td>6</td><td>64</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>7</td><td>128</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>8</td><td>256</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>9</td><td>512</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>10</td><td>1024</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>11</td><td>2048</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>12</td><td>4096</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>13</td><td>8192</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td>14</td><td>16384</td><td></td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td><td>--</td></tr>
</table></td></tr>
<tr><td></td><td>Maximum Required Input Frequency:</td><td></td><td>400 kHz</td></tr>
<tr><td></td><td>Hi-Resolution Stegmann Option:</td><td></td><td>Refer to specifications on page C-1</td></tr>
<tr><td></td><td>Encoder Voltage Supply:</td><td></td><td>11.5V dc @ 130 mA</td></tr>
<tr><td></td><td>Hi-Resolution Feedback:</td><td></td><td>Sine/Cosine 1V P-P Offset 2.5</td></tr>
<tr><td></td><td>Maximum Cable Length:</td><td></td><td>182 m (600 ft.)</td></tr>
<tr><td></td><td>RS-485 Interface:</td><td></td><td>Hi-Resolution Feedback Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up: Address, Command Number, Mode, Number of turns, Number of Sine/Cos cycles, Checksum</td></tr>
<tr><td></td><td>Customer-I/O Plug (P1) - Hi Res:</td><td></td><td>Allen-Bradley PN: S94262912
Weidmuller PN: BL3.50/90/12BK</td></tr>
<tr><td></td><td>Resolver Option:</td><td></td><td></td></tr>
<tr><td></td><td>Excitation Frequency:</td><td></td><td>2400 Hz</td></tr>
<tr><td></td><td>Excitation Voltage:</td><td></td><td>4.25-26 Vrms</td></tr>
<tr><td></td><td>Operating Frequency Range:</td><td></td><td>1 - 10 kHz</td></tr>
<tr><td></td><td>Feedback Voltage:</td><td></td><td>2V ± 300 mV</td></tr>
<tr><td></td><td>Maximum Cable Length:</td><td></td><td>304.8 meters (1000 ft.)</td></tr>
<tr><td>DriveLogix</td><td>User Available MemoryBase:
With Memory Expansion Board:</td><td></td><td>256 kbytes
768 kbytes</td></tr>
<tr><td></td><td>Battery:</td><td></td><td>1756-BA1 (Allen-Bradley PN 94194801) 0.59g lithium</td></tr>
<tr><td></td><td>Serial Cable:</td><td></td><td>1761-CBLPM02 to 1761-NET-AIC</td></tr>
<tr><td></td><td></td><td></td><td>1761-CBLPA00 to 1761-NET-AIC</td></tr>
<tr><td></td><td></td><td></td><td>1756-CP3 directly to controller</td></tr>
<tr><td></td><td></td><td></td><td>1747-CP3 directly to controller</td></tr>
<tr><td></td><td></td><td></td><td>category 3 (2)</td></tr>
<tr><td></td><td>Flex I/O Connection:</td><td></td><td>Up to (8) modules</td></tr>
<tr><td></td><td>FLEXBUS Current Output:</td><td></td><td>640 mA maximum @ 5.1V dc</td></tr>
<tr><td></td><td>Cable:</td><td></td><td>4100-CCF3</td></tr>
</table>

Drive Ratings and Protection Devices Catalog Number Designations

The first three characters of the drive catalog numbers in the tables on the following pages designate the type of drive control. The information in the tables are valid for PowerFlex drives with both the 700H and 700S control. Therefore, the third character of the drive catalog number in each table is replaced with an “x”. For ordering purposes, drives with the 700H control are designated as “20C” and drives with the 700S control are designated as “20D”.

Drive Ratings

The tables on the following pages provide drive ratings (including continuous, 1 minute and 3 seconds), PWM frequency ratings, ambient operating temperatures and watts loss information.

Table A.A 400 Volt AC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	Input Ratings	Output Amps			Watts Loss
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.	Watts
20xC261	9	132	-	2	40	263	261	287	410	2700
		-	110	2	40	207	205	308	410	2700
20xC300	9	160	-	2	40	302	300	330	450	3100
		-	132	2	40	247	245	368	490	3100
20xC385	10	200	-	2	40	388	385	424	600	4320
		-	160	2	40	302	300	450	600	4320
20xC460	10	250	-	2	40	463	460	506	770	5335
		-	200	2	40	388	385	578	770	5335
20xC500	10	250	-	2	40	504	500	550	750	5921
		-	250	2	40	423	420	630	840	5921
20xC590	11	315	-	2	40	594	590	649	956	6620
		-	250	2	40	524	520	780	956	6620
20xC650	11	355	-	2	40	655	650	715	1062	7538
		-	315	2	40	594	590	885	1062	7538
20xC730	11	400	-	2	40	735	730	803	1095	8312
		-	355	2	40	655	650	975	1170	8312
20xC820	12	450	-	2	40	826	820	902	1230	9201
		-	400	2	40	735	730	1095	1314	9201
20xC920	12	500	-	2	40	927	920	1012	1380	10670
		-	450	2	40	826	820	1230	1476	10670
20xC1K0	12	560	-	2	40	1038	1030	1133	1555	11729
		-	500	2	35	927	920	1370	1600	11729
20xC1K1	13	630	-	2	40	1158	1150	1265	1620	13801
		-	560	2	40	1038	1030	1545	1620	13801
20xC1K3	13	710	-	2	40	1310	1300	1430	2079	15077
		-	630	2	40	1158	1150	1725	2079	15077
20xC1K4	13	800	-	2	40	1461	1450	1595	2175	16511
		-	710	2	40	1209	1200	1800	2400	16511
20xC1K7[1]	14	1000	-	2	40	1783	1770	1947	2655	24800
		-	900	2	40	1612	1600	2400	2880	24800
20xC2K1[1]	14	1200	-	2	40	2166	2150	2365	3225	29900
		-	1100	2	40	1954	1940	2910	3492	29900
20xC2K7[1]	14	1600	-	2	40	2720	2700	2970	3933	39680
		-	1300	2	40	2317	2300	3287	3933	39680

(1) Not available with 700S Control.

Table A.B 480 Volt AC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	HP Rating		PWM Freq.	Temp.	Input Ratings	Output Amps			Watts Loss
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.	Watts
20xD261	9	200	-	2	40	252	261	287	410	2700
		-	150	2	40	207	205	308	410	2700
20xD300	9	250	-	2	40	290	300	330	450	3100
		-	200	2	40	247	245	368	490	3100
20xD385	10	300	-	2	40	372	385	424	600	4320
		-	250	2	40	302	300	450	600	4320
20xD460	10	350	-	2	40	444	460	506	770	5335
		-	300	2	40	388	385	578	770	5335
20xD500	10	450	-	2	40	483	500	550	750	5921
		-	350	2	40	423	420	630	840	5921
20xD590	11	500	-	2	40	570	590	649	956	6620
		-	450	2	40	524	520	780	956	6620
20xD650	11	500	-	2	40	628	650	715	1062	7538
		-	500	2	40	594	590	885	1062	7538
20xD730	11	600	-	2	40	705	730	803	1095	8312
		-	500	2	40	655	650	975	1170	8312
20xD820	12	700	-	2	40	792	820	902	1230	9201
		-	600	2	40	735	730	1095	1314	9201
20xD920	12	800	-	2	40	888	920	1012	1380	10670
		-	700	2	40	826	820	1230	1476	10670
20xD1K0	12	900	-	2	40	994	1030	1133	1555	11729
		-	800	2	35	927	920	1370	1600	11729
20xD1K1	13	1000	-	2	40	1110	1150	1265	1620	13801
		-	900	2	40	994	1030	1545	1620	13801
20xD1K3	13	1200	-	2	40	1255	1300	1430	2079	15077
		-	1000	2	40	1110	1150	1725	2079	15077
20xD1K4	13	1250	-	2	40	1400	1450	1595	2175	16511
		-	1000	2	40	1158	1200	1800	2400	16511
20xD1K7[1]	14	1500	-	2	40	1709	1770	1947	2655	24800
		-	1400	2	40	1545	1600	2400	2880	24800
20xD2K1[1]	14	1900	-	2	40	2076	2150	2365	3225	29900
		-	1700	2	40	1873	1940	2910	3492	29900
20xD2K7[1]	14	2300	-	2	40	2607	2700	2970	3933	39680
		-	2000	2	40	2220	2300	3287	3933	39680

(1) Not available with 700S Control.

Table A.C 600 Volt AC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	HP Rating		PWM Freq.	Temp.	Input Ratings	Output Amps			Watts Loss
		ND	HD	kHz	° C	Amps	Cont.	1 Min.	3 Sec.	Watts
20xE170	9	150	–	(3)	40	164	170	187	245	–
		–	150	(3)	40	139	144	216	245	–
20xE208	9	200	–	(3)	35	201	208	230	289	–
		–	150	(3)	40	164	170	250	289	–
20xE261	10	250	–	(3)	40	252	261	287	375	4206
		–	200	(3)	40	201	208	312	375	4206
20xE325	10	350	–	(3)	40	314	325	358	470	4751
		–	250	(3)	40	252	261	392	470	4751
20xE385	10	400	–	(3)	40	372	385	424	585	5527
		–	350	(3)	40	314	325	488	585	5527
20xE416	10	450	–	(3)	35	402	416	458	585	5622
		–	350	(3)	40	314	325	488	585	5622
20xE460	11	500	–	(3)	40	444	460	506	693	6345
		–	400	(3)	40	372	385	578	693	6345
20xE502	11	500	–	(3)	40	485	502	552	828	6925
		–	500	(3)	40	444	460	690	828	6925
20xE590	11	600	–	(3)	35	570	590	649	885	7539
		–	500	(3)	35	485	502	753	904	7539
20xE650	12	700	–	(3)	40	628	650	715	1062	9502
		–	650	(3)	40	570	590	885	1062	9502
20xE750	12	800	–	(3)	40	724	750	825	1170	10570
		–	700	(3)	40	628	650	975	1170	10570
20xE820(1)	12	900	–	(3)	35	792	820	902	1170	11082
		–	700	(3)	35	628	650	975	1170	11082
20xE920	13	1000	–	(3)	40	888	920	1012	1380	12690
		–	900	(3)	40	792	820	1230	1410	12690
20xE1K0	13	1100	–	(3)	40	994	1030	1133	1545	15907
		–	1000	(3)	40	888	920	1380	1755	15907
20xE1K1	13	1300	–	(3)	35	1139	1180	1298	1755	17306
		–	1100	(3)	35	994	1030	1463	1755	17306
20xE1K5	14	1600	–	(3)	40	1448	1500	1650	2250	22500
		–	1400	(3)	40	1255	1300	1950	2340	22500
20xE1K9(2)	14	2000	–	(3)	40	1834	1900	2090	2700	28500
		–	1600	(3)	40	1448	1500	2250	2700	28500
20xE2K2(2)	14	2400	–	(3)	30	2172	2250	2475	3335	33400
		–	2000	(3)	30	1834	1900	2782	3335	33400

(1) 20DE820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.
(3) Rated PWM for 700H control 1.5kHz, Rated PWM for 700S control 2.0kHz.

Table A.D 690 Volt AC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	Input Ratings	Output Amps			Watts Loss
		ND	HD	kHz	° C	Amps	Cont.	1 Min.	3 Sec.	Watts
20xF170	9	160	–	2	40	171	170	187	245	–
		–	132	2	40	145	144	216	245	–
20xF208	9	200	–	2	35	210	208	230	289	–
		–	160	2	40	171	170	250	289	–
20xF261	10	250	–	2	40	263	261	287	375	4206
		–	200	2	40	210	208	312	375	4206
20xF325	10	315	–	2	40	327	325	358	470	4751
		–	250	2	40	263	261	392	470	4751
20xF385	10	355	–	2	40	388	385	424	585	5527
		–	315	2	40	327	325	488	585	5527
20xF416	10	400	–	2	35	419	416	458	585	5622
		–	315	2	40	327	325	488	585	5622
20xF460	11	450	–	2	40	463	460	506	693	6345
		–	355	2	40	388	385	578	693	6345
20xF502	11	500	–	2	40	506	502	552	828	6925
		–	400	2	40	463	460	690	828	6925
20xF590	11	560	–	2	35	594	590	649	885	7539
		–	500	2	35	506	502	753	904	7539
20xF650	12	630	–	2	40	655	650	715	1062	9502
		–	560	2	40	594	590	885	1062	9502
20xF750	12	710	–	2	40	756	750	825	1170	10570
		–	630	2	40	655	650	975	1170	10570
20xF820[1]	12	800	–	2	35	826	820	902	1170	11082
		–	630	2	35	655	650	975	1170	11082
20xF920	13	900	–	2	40	927	920	1012	1380	12690
		–	800	2	40	826	820	1230	1410	12690
20xF1K0	13	1000	–	2	40	1038	1030	1133	1545	15907
		–	900	2	40	927	920	1380	1755	15907
20xF1K1	13	1100	–	2	35	1189	1180	1298	1755	17306
		–	1000	2	35	1038	1030	1463	1755	17306
20xF1K5	14	1500	–	2	40	1511	1500	1650	2250	22500
		–	1300	2	40	1310	1300	1950	2340	22500
20xF1K9[2]	14	1800	–	2	40	1914	1900	2090	2700	28500
		–	1500	2	40	1511	1500	2250	2700	28500
20xF2K2[2]	14	2000	–	2	30	2267	2250	2475	3335	33400
		–	1800	2	30	1914	1900	2782	3335	33400

(1) 20DF820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

Table A.E 540 Volt DC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	DC Input Ratings	Output Amps		
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.
20xH261	9	132	-	2	40	307	261	287	410
		-	110	2	40	241	205	308	410
20xH300	9	160	-	2	40	353	300	330	450
		-	132	2	40	288	245	368	490
20xH385	10	200	-	2	40	453	385	424	600
		-	160	2	40	353	300	450	600
20xH460	10	250	-	2	40	541	460	506	770
		-	200	2	40	453	385	578	770
20xH500	10	250	-	2	40	589	500	550	750
		-	250	2	40	494	420	630	840
20xH590	11	315	-	2	40	695	590	649	956
		-	250	2	40	612	520	780	956
20xH650	11	355	-	2	40	765	650	715	1062
		-	315	2	40	695	590	885	1062
20xH730	11	400	-	2	40	859	730	803	1095
		-	355	2	40	765	650	975	1170
20xH820	12	450	-	2	40	965	820	902	1230
		-	400	2	40	859	730	1095	1314
20xH920	12	500	-	2	40	1083	920	1012	1380
		-	450	2	40	965	820	1230	1476
20xH1K0	12	560	-	2	40	1213	1030	1133	1555
		-	500	2	35	1083	920	1370	1600
20xH1K1	13	630	-	2	40	1354	1150	1265	1620
		-	560	2	40	1213	1030	1545	1620
20xH1K3	13	710	-	2	40	1530	1300	1430	2079
		-	630	2	40	1354	1150	1725	2079
20xH1K4	13	800	-	2	40	1707	1450	1595	2175
		-	710	2	40	1413	1200	1800	2400
20xH1K7[(1)]	14	1000	-	2	40	2084	1770	1947	2655
		-	900	2	40	1883	1600	2400	2880
20xH2K1[(1)]	14	1200	-	2	40	2531	2150	2365	3225
		-	1100	2	40	2284	1940	2910	3492
20xH2K7[(1)]	14	1600	-	2	40	3178	2700	2970	3933
		-	1300	2	40	2708	2300	3287	3933

(1) Not available with 700S Control.

Table A.F 650 Volt DC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	HP Rating		PWM Freq.	Temp.	DC Input Ratings	Output Amps		
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.
20xJ261	9	200	-	2	40	294	261	287	410
		-	150	2	40	231	205	308	410
20xJ300	9	250	-	2	40	338	300	330	450
		-	200	2	40	294	245	368	490
20xJ385	10	300	-	2	40	434	385	424	600
		-	250	2	40	338	300	450	600
20xJ460	10	350	-	2	40	519	460	506	770
		-	300	2	40	434	385	578	770
20xJ500	10	450	-	2	40	564	500	550	750
		-	350	2	40	474	420	630	840
20xJ590	11	500	-	2	40	666	590	649	956
		-	450	2	40	587	520	780	956
20xJ650	11	500	-	2	40	733	650	715	1062
		-	500	2	40	666	590	885	1062
20xJ730	11	600	-	2	40	824	730	803	1095
		-	500	2	40	733	650	975	1170
20xJ820	12	700	-	2	40	925	820	902	1230
		-	600	2	40	824	730	1095	1314
20xJ920	12	800	-	2	40	1038	920	1012	1380
		-	700	2	40	925	820	1230	1476
20xJ1K0	12	900	-	2	40	1162	1030	1133	1555
		-	800	2	35	1038	920	1370	1600
20xJ1K1	13	1000	-	2	40	1297	1150	1265	1620
		-	900	2	40	1162	1030	1545	1620
20xJ1K3	13	1200	-	2	40	1467	1300	1430	2079
		-	1000	2	40	1297	1150	1725	2079
20xJ1K4	13	1250	-	2	40	1636	1450	1595	2175
		-	1000	2	40	1354	1200	1800	2400
20xJ1K7[(1)]	14	1500	-	2	40	1997	1770	1947	2655
		-	1400	2	40	1805	1600	2400	2880
20xJ2K1[(1)]	14	1900	-	2	40	2425	2150	2365	3225
		-	1700	2	40	2189	1940	2910	3492
20xJ2K7[(1)]	14	2300	-	2	40	3046	2700	2970	3933
		-	2000	2	40	2595	2300	3287	3933

(1) Not available with 700S Control.

Table A.G 810 Volt DC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	HP Rating		PWM Freq.	Temp.	DC Input Ratings	Output Amps		
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.
20xK170	9	150	–	2	40	192	170	187	245
		–	150	2	40	162	144	216	245
20xK208	9	200	–	2	35	235	208	230	289
		–	150	2	40	192	170	250	289
20xK261	10	250	–	2	40	294	261	287	375
		–	200	2	40	235	208	312	375
20xK325	10	350	–	2	40	367	325	358	470
		–	250	2	40	294	261	392	470
20xK385	10	400	–	2	40	434	385	424	585
		–	350	2	40	367	325	488	585
20xK416	10	450	–	2	35	469	416	458	585
		–	350	2	40	367	325	488	585
20xK460	11	500	–	2	40	519	460	506	693
		–	400	2	40	434	385	578	693
20xK502	11	500	–	2	40	566	502	552	828
		–	500	2	40	519	460	690	828
20xK590	11	600	–	2	35	666	590	649	885
		–	500	2	35	566	502	753	904
20xK650	12	700	–	2	40	733	650	715	1062
		–	650	2	40	666	590	885	1062
20xK750	12	800	–	2	40	846	750	825	1170
		–	700	2	40	733	650	975	1170
20xK820 (1)	12	900	–	2	35	925	820	902	1170
		–	700	2	35	733	650	975	1170
20xK920	13	1000	–	2	40	1038	920	1012	1380
		–	900	2	40	925	820	1230	1410
20xK1K0	13	1100	–	2	40	1162	1030	1133	1545
		–	1000	2	40	1038	920	1380	1755
20xK1K1	13	1300	–	2	35	1331	1180	1298	1755
		–	1100	2	35	1162	1030	1463	1755
20xK1K5	14	1600	–	2	40	1692	1500	1650	2250
		–	1400	2	40	1467	1300	1950	2340
20xK1K9(2)	14	2000	–	2	40	2143	1900	2090	2700
		–	1600	2	40	1692	1500	2250	2700
20xK2K2(2)	14	2400	–	2	30	2538	2250	2475	3335
		–	2000	2	30	2143	1900	2782	3335

(1) 20DK820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

Table A.H 932 Volt DC Input Frames 9 - 14 Drive Ratings

Drive Catalog Number	Frame	kW Rating		PWM Freq.	Temp.	DC Input Ratings	Output Amps		
		ND	HD	kHz	°C	Amps	Cont.	1 Min.	3 Sec.
20xM170	9	160	–	2	40	200	170	187	245
		–	132	2	40	170	144	216	245
20xM208	9	200	–	2	35	245	208	230	289
		–	160	2	40	200	170	250	289
20xM261	10	250	–	2	40	307	261	287	375
		–	200	2	40	245	208	312	375
20xM325	10	315	–	2	40	383	325	358	470
		–	250	2	40	307	261	392	470
20xM385	10	355	–	2	40	453	385	424	585
		–	315	2	40	383	325	488	585
20xM416	10	400	–	2	35	490	416	458	585
		–	315	2	40	383	325	488	585
20xM460	11	450	–	2	40	542	460	506	693
		–	355	2	40	453	385	578	693
20xM502	11	500	–	2	40	591	502	552	828
		–	400	2	40	542	460	690	828
20xM590	11	560	–	2	35	695	590	649	885
		–	500	2	35	591	502	753	904
20xM650	12	630	–	2	40	765	650	715	1062
		–	560	2	40	695	590	885	1062
20xM750	12	710	–	2	40	883	750	825	1170
		–	630	2	40	765	650	975	1170
20xM820[1]	12	800	–	2	35	965	820	902	1170
		–	630	2	35	765	650	975	1170
20xM920	13	900	–	2	40	1038	920	1012	1380
		–	800	2	40	925	820	1230	1410
20xM1K0	13	1000	–	2	40	1162	1030	1133	1545
		–	900	2	40	1038	920	1380	1755
20xM1K1	13	1100	–	2	35	1331	1180	1298	1755
		–	1000	2	35	1162	1030	1463	1755
20xM1K5	14	1500	–	2	40	1766	1500	1650	2250
		–	1300	2	40	1530	1300	1950	2340
20xM1K9[2]	14	1800	–	2	40	2237	1900	2090	2700
		–	1500	2	40	1766	1500	2250	2700
20xM2K2[2]	14	2000	–	2	30	2649	2250	2475	3335
		–	1800	2	30	2237	1900	2782	3335

(1) 20DM820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

Drive Fuse & Circuit Breaker Ratings

The tables on the following pages provide recommended AC line input fuse and circuit breaker information. Both types of short circuit protection are acceptable for UL and IEC requirements. Sizes listed are the recommended sizes based on 40 degree C and the U.S. N.E.C. Other country, state or local codes may require different ratings. Tables with DC Link fuse recommendations are also provided.

Fusing

If fuses are chosen as the desired protection method, refer to the recommended types listed below. If available amp ratings do not match the tables provided, the closest fuse rating that exceeds the drive rating should be chosen.

- IEC – BS88 (British Standard) Parts 1 & 2[(1)], EN60269-1, Parts 1 & 2, type gG or equivalent should be used.
- UL – UL Class T, J or L should be used.

Circuit Breakers

The "non-fuse" listings in the following tables include both circuit breakers (inverse time or instantaneous trip) and motor circuit protectors for AC Input drives. **If one of these is chosen as the desired protection method**, the following requirements apply.

- IEC and UL – Both types of devices are acceptable for IEC and UL installations.

(1) Typical designations include, but may not be limited to the following; Ora 1 & 2:AC, AD, BC, BD, CD, DD, ED, EFS, EF, FF, FG, GF, GG, GH

Table A.I 400 Volt AC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	kW Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker [5]	Motor Circuit Protector [7]
		ND	HD	Amps	Min. [2]	Max. [3]	Min. [2]	Max. [3]		Max. [6]	Max.
20xC261	9	132	-	263	350	550	350	700	170M5813	700	400
		-	110	207	275	450	275	600	170M5813	600	300
20xC300	9	160	-	302	400	650	400	900	170M5813	900	400
		-	132	247	350	500	350	700	170M5813	700	400
20xC385	10	200	-	388	500	850	500	1100	170M5813	1100	600
		-	160	302	400	650	400	900	170M5813	900	400
20xC460	10	250	-	463	600	1000	600	1300	170M8547	1300	600
		-	200	388	500	850	500	1100	170M8547	1100	600
20xC500	10	250	-	504	650	1100	650	1500	170M8547	1500	700
		-	250	423	550	900	550	1200	170M8547	1200	600
20xC590	11	315	-	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		-	250	524	700 (1 per phs) 350 (2 per phs)	1100	700 (1 per phs) 350 (2 per phs)	1500	170M5813	1500	700
20xC650	11	355	-	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	1000
		-	315	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xC730	11	400	-	735	1000 (1 per phs) 500 (2 per phs)	1600	1000 (1 per phs) 500 (2 per phs)	2100	170M5813	2100	1200
		-	355	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	1000
20xC820	12	450	-	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
		-	400	735	1000 (1 per phs) 500 (2 per phs)	1600	1000 (1 per phs) 500 (2 per phs)	2100	170M8547	2100	1200
20xC920	12	500	-	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
		-	450	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
20xC1K0	12	560	-	1038	1350 (1 per phs) 700 (2 per phs)	2300	1350 (1 per phs) 700 (2 per phs)	3000	170M8547	3000	1400
		-	500	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
20xC1K1	13	630	-	1158	1350 (1 per phs) 700 (2 per phs)	2300	1350 (1 per phs) 700 (2 per phs)	3000	170M6466 [4]	3000	1400
		-	560	1038	1500 (1 per phs) 750 (2 per phs)	2500	1500 (1 per phs) 750 (2 per phs)	3400	170M6466 [4]	3400	1500
20xC1K3	13	710	-	1310	1700 (1 per phs) 850 (2 per phs)	2900	1700 (1 per phs) 850 (2 per phs)	3900	170M6466 [4]	3900	1700
		-	630	1158	1500 (1 per phs) 750 (2 per phs)	2500	1500 (1 per phs) 750 (2 per phs)	3400	170M6466 [4]	3400	1500
20xC1K4	13	800	-	1461	1900 (1 per phs) 950 (2 per phs)	3000	1900 (1 per phs) 950 (2 per phs)	4300	170M6466 [4]	4300	1900
		-	710	1209	1600 (1 per phs) 800 (2 per phs)	2700	1600 (1 per phs) 800 (2 per phs)	3600	170M6466 [4]	3600	1600
20xC1K7 [1]	14	1000	-	1783	2500 (1 per phs) 825 (3 per phs)	3900	2500 (1 per phs) 825 (3 per phs)	5300	170M6466	5300	2500
		-	900	1612	2100 (1 per phs) 700 (3 per phs)	3500	2100 (1 per phs) 700 (3 per phs)	4800	170M6466	4800	2100
20xC2K1 [1]	14	1200	-	2166	3000 (1 per phs) 1000 (3 per phs)	4800	3000 (1 per phs) 1000 (3 per phs)	6400	170M6466	6400	3000
		-	1100	1954	2500 (1 per phs) 825 (3 per phs)	4300	2500 (1 per phs) 825 (3 per phs)	5800	170M6466	5800	2500
20xC2K7 [1]	14	1600	-	2720	3500 (1 per phs) 1200 (3 per phs)	6000	3500 (1 per phs) 1200 (3 per phs)	8000	170M6466	8000	3500
		-	1300	2317	3000 (1 per phs) 1000 (3 per phs)	5000	3000 (1 per phs) 1000 (3 per phs)	6900	170M6466	6900	3000

(1) Not available with 700S Control.

(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(3) Maximum protection device size is the highest rated device that supplies drive protection.

(4) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(5) Inverse time breaker. Ratings shown are maximum.

(6) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(7) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

Table A.J 480 Volt AC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	HP Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker(5)	Motor Circuit Protector(7)
		ND	HD	Amps	Min.(2)	Max.(3)	Min.(2)	Max.(3)		Max.(6)	Max.
20xD261	9	200	-	252	350	550	350	700	170M5813	700	400
		-	150	207	275	450	275	600	170M5813	600	300
20xD300	9	250	-	290	400	650	400	900	170M5813	900	400
		-	200	247	350	550	350	700	170M5813	700	400
20xD385	10	300	-	372	500	850	500	1100	170M5813	1100	600
		-	250	302	400	650	400	900	170M5813	900	400
20xD460	10	350	-	444	600	1000	600	1300	170M8547	1300	600
		-	300	388	500	850	500	1100	170M8547	1100	600
20xD500	10	450	-	483	650	1000	650	1500	170M8547	1500	700
		-	350	423	550	900	550	1200	170M8547	1200	600
20xD590	11	500	-	570	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		-	450	524	700 (1 per phs) 350 (2 per phs)	1100	700 (1 per phs) 350 (2 per phs)	1500	170M5813	1500	700
20xD650	11	500	-	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	800
		-	500	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xD730	11	600	-	705	900 (1 per phs) 450 (2 per phs)	1600	900 (1 per phs) 450 (2 per phs)	2100	170M5813	2100	900
		-	500	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xD820	12	700	-	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M8547	2400	1000
		-	600	735	900 (1 per phs) 475 (2 per phs)	1600	900 (1 per phs) 475 (2 per phs)	2100	170M8547	2100	1000
20xD920	12	800	-	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
		-	700	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M8547	2400	1200
20xD1K0	12	900	-	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M8547	3000	1300
		-	800	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M8547	2700	1200
20xD1K1	13	1000	-	1110	1400 (1 per phs) 700 (2 per phs)	2500	1400 (1 per phs) 700 (2 per phs)	3400	170M6466 (4)	3400	1400
		-	900	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 (4)	3000	1300
20xD1K3	13	1200	-	1255	1600 (1 per phs) 800 (2 per phs)	2900	1600 (1 per phs) 800 (2 per phs)	3900	170M6466 (4)	3900	1600
		-	1000	1110	1400 (1 per phs) 700 (2 per phs)	2500	1400 (1 per phs) 700 (2 per phs)	3400	170M6466 (4)	3400	1400
20xD1K4	13	1250	-	1400	1800 (1 per phs) 900 (2 per phs)	3200	1800 (1 per phs) 900 (2 per phs)	4300	170M6466 (4)	4300	1800
		-	1000	1158	1500 (1 per phs) 750 (2 per phs)	2700	1500 (1 per phs) 750 (2 per phs)	3600	170M6466 (4)	3600	1500
20xD1K7(1)	14	1500	-	1709	2200 (1 per phs) 750 (3 per phs)	3800	2200 (1 per phs) 750 (3 per phs)	5300	170M6466	5300	2200
		-	1400	1545	2000 (1 per phs) 675 (3 per phs)	3600	2000 (1 per phs) 675 (3 per phs)	4800	170M6466	4800	2000

Drive Catalog Number	Frame	HP Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker[5]	Motor Circuit Protector[7]
		ND	HD	Amps	Min.[2]	Max.[3]	Min.[2]	Max.[3]		Max.[6]	Max.
20xD2K1[1]	14	1900	-	2076	2600 (1 per phs) 900 (3 per phs)	4800	2600 (1 per phs) 900 (3 per phs)	6400	170M6466	6400	2600
		-	1700	1873	2400 (1 per phs) 800 (3 per phs)	4300	2400 (1 per phs) 800 (3 per phs)	5800	170M6466	5800	2400
20xD2K7[1]	14	2300	-	2607	3000 (1 per phs) 1100 (3 per phs)	6000	3000 (1 per phs) 1100 (3 per phs)	8000	170M6466	8000	3300
		-	2000	2220	2800 (1 per phs) 900 (3 per phs)	5000	2800 (1 per phs) 900 (3 per phs)	6900	170M6466	6900	2800

(1) Not available with 700S Control.

(2) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(3) Maximum protection device size is the highest rated device that supplies drive protection.

(4) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(5) Inverse time breaker. Ratings shown are maximum.

(6) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(7) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

Table A.K 600 Volt AC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	HP Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker[6]	Motor Circuit Protector[8]
		ND	HD	Amps	Min.[3]	Max.[4]	Min.[3]	Max.[4]		Max[7]	Max.
20xE170	9	150	–	164	225	375	225	500	170M3819	500	250
		–	150	139	175	300	175	500	170M3819	500	200
20xE208	9	200	–	201	275	450	275	600	170M3819	600	300
		–	150	164	225	375	225	500	170M3819	500	250
20xE261	10	250	–	252	325	575	325	775	170M5813	700	350
		–	200	201	275	450	275	600	170M5813	600	300
20xE325	10	350	–	314	400	725	400	950	170M5813	900	450
		–	250	252	325	575	325	775	170M5813	750	400
20xE385	10	400	–	372	475	850	475	1100	170M5813	1100	500
		–	350	314	400	725	400	950	170M5813	900	450
20xE416	10	450	–	402	525	900	525	1200	170M5813	1200	550
		–	350	314	400	725	400	950	170M5813	900	450
20xE460	11	500	–	444	575 (1 per phs) 300 (2 per phs)	1000	575 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
		–	400	372	475 (1 per phs) 250 (2 per phs)	850	475 (1 per phs) 250 (2 per phs)	1100	170M8547	1100	500
20xE502	11	500	–	485	625 (1 per phs) 325 (2 per phs)	1100	625 (1 per phs) 325 (2 per phs)	1500	170M8547	1500	650
		–	500	444	575 (1 per phs) 300 (2 per phs)	1000	575 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
20xE590	11	600	–	570	725 (1 per phs) 375(2 per phs)	1300	725 (1 per phs) 375(2 per phs)	1700	170M5813	1700	800
		–	500	485	625 (1 per phs) 325 (2 per phs)	1100	625 (1 per phs) 325 (2 per phs)	1500	170M5813	1500	700
20xE650	12	700	–	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
		–	650	570	725 (1 per phs) 375 (2 per phs)	1300	725 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xE750	12	800	–	724	950 (1 per phs) 475 (2 per phs)	1600	950 (1 per phs) 475 (2 per phs)	2200	170M5813	2200	1000
		–	700	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
20xE820[1]	12	900	–	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M5813	2400	1100
		–	700	628	800 (1 per phs) 400 (2 per phs)	1400	800 (1 per phs) 400 (2 per phs)	1900	170M5813	1900	900
20xE920	13	1000	–	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466 [5]	2700	1200
		–	900	792	1000 (1 per phs) 500 (2 per phs)	1800	1000 (1 per phs) 500 (2 per phs)	2400	170M6466 [5]	2400	1100

Drive Catalog Number	Frame	HP Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker[6]	Motor Circuit Protector[8]
		ND	HD	Amps	Min.[3]	Max.[4]	Min.[3]	Max.[4]		Max [7]	Max.
20xE1K0	13	1100	–	994	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 [5]	3000	1300
		–	1000	888	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466 [5]	2700	1200
20xE1K1	13	1300	–	1139	1500 (1 per phs) 750 (2 per phs)	2600	1500 (1 per phs) 750 (2 per phs)	3500	170M6466 [5]	3500	1500
		–	1100	994	1300 (1 per phs) 650 (2 per phs)	2200	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 [5]	3000	1300
20xE1K5	14	1000	–	1448	1900 (1 per phs) 650 (3 per phs)	3300	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
		–	900	1255	1600 (1 per phs) 550 (3 per phs)	2900	1600 (1 per phs) 550 (3 per phs)	3900	170M6466	3900	1700
20xE1K9[2]	14	1100	–	1834	2300 (1 per phs) 800 (3 per phs)	4200	2300 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400
		–	1000	1448	1900 (1 per phs) 650 (3 per phs)	3200	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
20xE2K2[2]	14	1200	–	2172	2800 (1 per phs) 950 (3 per phs)	5000	2800 (1 per phs) 950 (3 per phs)	6700	170M6466	6700	2900
		–	1100	1834	2300 (1 per phs) 800 (3 per phs)	4200	2300 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400

(1) 20DE820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.

(2) Not available with 700S Control.

(3) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(4) Maximum protection device size is the highest rated device that supplies drive protection.

(5) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(6) Inverse time breaker. Ratings shown are maximum.

(7) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(8) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

Table A.L 690 Volt AC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	kW Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker[6]	Motor Circuit Protector[8]
		ND	HD	Amps	Min.[3]	Max. [4]	Min.[3]	Max.[4]		Max.[7]	Max.
20xF170	9	160	–	171	225	375	225	500	170M3819	500	250
		–	132	145	200	300	200	500	170M3819	400	200
20xF208	9	200	–	210	275	450	275	600	170M3819	600	300
		–	160	171	225	375	225	500	170M3819	500	250
20xF261	10	250	–	263	350	575	350	775	170M5813	750	350
		–	200	210	275	450	275	600	170M5813	600	300
20xF325	10	315	–	327	425	725	425	950	170M5813	900	450
		–	250	263	350	575	350	775	170M5813	750	400
20xF385	10	355	–	388	500	850	500	1100	170M5813	1100	500
		–	315	327	425	725	425	950	170M5813	900	450
20xF416	10	400	–	419	525	900	525	1200	170M5813	1200	550
		–	315	327	425	700	425	950	170M5813	900	450
20xF460	11	500	–	463	600 (1 per phs) 300 (2 per phs)	1000	600 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
		–	400	388	500 (1 per phs) 250 (2 per phs)	850	500 (1 per phs) 250 (2 per phs)	1100	170M8547	1100	500
20xF502	11	560	–	506	650 (1 per phs) 325 (2 per phs)	1100	650 (1 per phs) 325 (2 per phs)	1500	170M8547	1500	650
		–	500	463	600 (1 per phs) 300 (2 per phs)	1000	600 (1 per phs) 300 (2 per phs)	1300	170M8547	1300	600
20xF590	11	580	–	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
		–	500	506	650 (1 per phs) 325 (2 per phs)	1100	650 (1 per phs) 325 (2 per phs)	1500	170M5813	1500	700

Drive Catalog Number	Frame	kW Rating		Input Ratings	Dual Element Time Delay Fuse		Non-Time Delay Fuse		Bussmann Style Semi-Conductor Fuse	Circuit Breaker[6]	Motor Circuit Protector[8]
		ND	HD	Amps	Min.[3]	Max.[4]	Min.[3]	Max.[4]		Max.[7]	Max.
20xF650	12	630	–	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
		–	560	594	750 (1 per phs) 375 (2 per phs)	1300	750 (1 per phs) 375 (2 per phs)	1700	170M5813	1700	800
20xF750	12	710	–	756	950 (1 per phs) 475 (2 per phs)	1600	950 (1 per phs) 475 (2 per phs)	2200	170M5813	2200	1000
		–	630	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xF820[1]	12	800	–	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M5813	2400	1100
		–	630	655	850 (1 per phs) 425 (2 per phs)	1400	850 (1 per phs) 425 (2 per phs)	1900	170M5813	1900	900
20xF920	13	900	–	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466 [5]	2700	1200
		–	800	826	1100 (1 per phs) 550 (2 per phs)	1800	1100 (1 per phs) 550 (2 per phs)	2400	170M6466 [5]	2400	1100
20xF1K0	13	1000	–	1038	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 [5]	3000	1300
		–	900	927	1200 (1 per phs) 600 (2 per phs)	2000	1200 (1 per phs) 600 (2 per phs)	2700	170M6466 [5]	2700	1200
20xF1K1	13	1100	–	1189	1500 (1 per phs) 750 (2 per phs)	2600	1500 (1 per phs) 750 (2 per phs)	3500	170M6466 [5]	3500	1500
		–	1000	1038	1300 (1 per phs) 650 (2 per phs)	2300	1300 (1 per phs) 650 (2 per phs)	3000	170M6466 [5]	3000	1300
20xF1K5	14	1500	–	1511	1900 (1 per phs) 650 (3 per phs)	3300	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
		–	1300	1310	1700 (1 per phs) 575 (3 per phs)	2900	1700 (1 per phs) 575 (3 per phs)	3900	170M6466	3900	1700
20xF1K9[2]	14	1800	–	1914	2400 (1 per phs) 800 (3 per phs)	4200	2400 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400
		–	1500	1511	1900 (1 per phs) 650 (3 per phs)	3200	1900 (1 per phs) 650 (3 per phs)	4500	170M6466	4500	1900
20xF2K2[2]	14	2000	–	2267	2900 (1 per phs) 950 (3 per phs)	5000	2900 (1 per phs) 950 (3 per phs)	6700	170M6466	6700	2900
		–	1800	1914	2400 (1 per phs) 800 (3 per phs)	4200	2400 (1 per phs) 800 (3 per phs)	5700	170M6466	5700	2400

(1) 20DF820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.

(2) Not available with 700S Control.

(3) Minimum protection device size is the lowest rated device that supplies maximum protection without nuisance tripping.

(4) Maximum protection device size is the highest rated device that supplies drive protection.

(5) These fuses and disconnect are supplied with AC input NEMA/UL Type 1 drives.

(6) Inverse time breaker. Ratings shown are maximum.

(7) Maximum allowable rating by US NEC. Exact size must be chosen for each installation.

(8) Motor Circuit Protector - instantaneous trip circuit breaker. For US NEC minimum size is 125% of motor/drive FLA. Ratings shown are suggested. Instantaneous trip settings must be set to US NEC code. Not to exceed 1300% FLA.

Table A.M 540 Volt DC Input Frames 9 - 14 Drive Protection Devices

		kW Rating		DC Input Ratings		
Drive Catalog Number	Frame	ND	HD	Amps	Fuse	Bussmann Style Fuse
20xH261	9	132	-	307	500	170M6608
		-	110	241	500	170M6608
20xH300	9	160	-	353	630	170M6610
		-	132	288	630	170M6610
20xH385	10	200	-	453	700	170M6611
		-	160	353	700	170M6611
20xH460	10	250	-	541	900	170M6613
		-	200	453	900	170M6613
20xH500	10	250	-	589	500 (2 per phs)	170M6608
		-	250	494	500 (2 per phs)	170M6608
20xH590	11	315	-	695	550 (2 per phs)	170M6609
		-	250	612	550 (2 per phs)	170M6609
20xH650	11	355	-	765	630 (2 per phs)	170M6610
		-	315	695	630 (2 per phs)	170M6610
20xH730	11	400	-	859	700 (2 per phs)	170M6611
		-	355	765	700 (2 per phs)	170M6611
20xH820	12	450	-	965	700 (2 per phs)	170M6611
		-	400	859	700 (2 per phs)	170M6611
20xH920	12	500	-	1083	550 (3 per phs)	170M6609
		-	450	965	550 (3 per phs)	170M6609
20xH1K0	12	560	-	1213	630 (3 per phs)	170M6610
		-	500	1083	630 (3 per phs)	170M6610
20xH1K1	13	630	-	1354	2400	170M7107
		-	560	1213	2400	170M7107
20xH1K3	13	710	-	1530	2400	170M7107
		-	630	1354	2400	170M7107
20xH1K4	13	800	-	1707	2400	170M7107
		-	710	1413	2400	170M7107
20xH1K7(1)	14	1000	-	2084	–	170M8610
		-	900	1883	–	170M8610
20xH2K1(1)	14	1200	-	2531	–	170M8610
		-	1100	2284	–	170M8610
20xH2K7(1)	14	1600	-	3178	–	170M8610
		-	1300	2708	–	170M8610

(1) Not available with 700S Control.

Table A.N 650 Volt DC Input Frames 9 - 14 Drive Protection Devices

		HP Rating		DC Input Ratings		
Drive Catalog Number	Frame	ND	HD	Amps	Fuse	Bussmann Style Fuse
20xJ261	9	200	-	294	500	170M6608
		-	150	231	500	170M6608
20xJ300	9	250	-	338	630	170M6610
		-	200	294	630	170M6610
20xJ385	10	300	-	434	700	170M6611
		-	250	338	700	170M6611
20xJ460	10	350	-	519	900	170M6613
		-	300	434	900	170M6613
20xJ500	10	450	-	564	500 (2 per phs)	170M6608
		-	350	474	500 (2 per phs)	170M6608
20xJ590	11	500	-	666	550 (2 per phs)	170M6609
		-	450	587	550 (2 per phs)	170M6609
20xJ650	11	500	-	733	630 (2 per phs)	170M6610
		-	500	666	630 (2 per phs)	170M6610
20xJ730	11	600	-	824	700 (2 per phs)	170M6611
		-	500	733	700 (2 per phs)	170M6611
20xJ820	12	700	-	925	700 (2 per phs)	170M6611
		-	600	824	700 (2 per phs)	170M6611

Drive Catalog Number	Frame	HP Rating		DC Input Ratings	Fuse	Bussmann Style Fuse
		ND	HD	Amps		
20xJ920	12	800	-	1038	550 (3 per phs)	170M6609
		-	700	925	550 (3 per phs)	170M6609
20xJ1K0	12	900	-	1162	630 (3 per phs)	170M6610
		-	800	1038	630 (3 per phs)	170M6610
20xJ1K1	13	1000	-	1297	2400	170M7107
		-	900	1162	2400	170M7107
20xJ1K3	13	1200	-	1467	2400	170M7107
		-	1000	1297	2400	170M7107
20xJ1K4	13	1250	-	1636	2400	170M7107
		-	1000	1354	2400	170M7107
20xJ1K7(1)	14	1500	-	1997	–	170M8610
		-	1400	1805	–	170M8610
20xJ2K1(1)	14	1900	-	2425	–	170M8610
		-	1700	2189	–	170M8610
20xJ2K7(1)	14	2300	-	3046	–	170M8610
		-	2000	2595	–	170M8610

(1) Not available with 700S Control.

Table A.O 810 Volt DC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	HP Rating		DC Input Ratings	Fuse	Bussmann Style Fuse
		ND	HD	Amps		
20xK170	9	150	–	192	400	170M5608
		–	150	162	400	170M5608
20xK208	9	200	–	235	450	170M5609
		–	150	192	450	170M5609
20xK261	10	250	–	294	450	170M5609
		–	200	235	450	170M5609
20xK325	10	350	–	367	550	170M6609
		–	250	294	550	170M6609
20xK385	10	400	–	434	700	170M6611
		–	350	367	700	170M6611
20xK416	10	450	–	469	800	170M6612
		–	350	367	800	170M6612
20xK460	11	500	–	519	450 (2 per phs)	170M5609
		–	400	434	450 (2 per phs)	170M5609
20xK502	11	500	–	566	500 (2 per phs)	170M6608
		–	500	519	500 (2 per phs)	170M6608
20xK590	11	600	–	666	500 (2 per phs)	170M6608
		–	500	566	500 (2 per phs)	170M6608
20xK650	12	700	–	733	500 (2 per phs)	170M6608
		–	650	666	500 (2 per phs)	170M6608
20xK750	12	800	–	846	630 (2 per phs)	170M6610
		–	700	733	630 (2 per phs)	170M6610
20xK820 (1)	12	900	–	925	630 (2 per phs)	170M6610
		–	700	733	630 (2 per phs)	170M6610
20xK920	13	1000	–	1038	2400	170M7107
		–	900	925	2400	170M7107
20xK1K0	13	1100	–	1162	2400	170M7107
		–	1000	1038	2400	170M7107
20xK1K1	13	1300	–	1331	2400	170M7107
		–	1100	1162	2400	170M7107
20xK1K5	14	1600	–	1692	–	170M8610
		–	1400	1467	–	170M8610
20xK1K9(2)	14	2000	–	2143	–	170M8610
		–	1600	1692	–	170M8610
20xK2K2(2)	14	2400	–	2538	–	170M8610
		–	2000	2143	–	170M8610

(1) 20DK820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

Table A.P 932 Volt DC Input Frames 9 - 14 Drive Protection Devices

Drive Catalog Number	Frame	kW Rating		DC Input Ratings	Fuse	Bussmann Style Fuse
		ND	HD	Amps		
20xM170	9	160	–	200	315	170M3746
		–	132	170	315	170M3746
20xM208	9	200	–	245	400	170M5742
		–	160	200	400	170M5742
20xM261	10	250	–	307	500	170M5744
		–	200	245	500	170M5744
20xM325	10	315	–	383	630	170M5746
		–	250	307	630	170M5746
20xM385	10	355	–	453	700	170M6745
		–	315	383	700	170M6745
20xM416	10	400	–	490	700	170M6745
		–	315	383	700	170M6745
20xM460	11	450	–	542	450 (2 per phs)	170M5743
		–	355	453	450 (2 per phs)	170M5743
20xM502	11	500	–	591	500 (2 per phs)	170M5744
		–	400	542	500 (2 per phs)	170M5744
20xM590	11	560	–	695	500 (2 per phs)	170M5744
		–	500	591	500 (2 per phs)	170M5744
20xM650	12	630	–	765	550 (2 per phs)	170M5745
		–	560	695	550 (2 per phs)	170M5745
20xM750	12	710	–	883	630 (2 per phs)	170M5746
		–	630	765	630 (2 per phs)	170M5746
20xM820(1)	12	800	–	965	630 (2 per phs)	170M5746
		–	630	765	630 (2 per phs)	170M5746
20xM920	13	900	–	1038	2400	170M7107
		–	800	925	2400	170M7107
20xM1K0	13	1000	–	1162	2400	170M7107
		–	900	1038	2400	170M7107
20xM1K1	13	1100	–	1331	2400	170M7107
		–	1000	1162	2400	170M7107
20xM1K5	14	1500	–	1766	–	170M8610
		–	1300	1530	–	170M8610
20xM1K9(2)	14	1800	–	2237	–	170M8610
		–	1500	1766	–	170M8610
20xM2K2(2)	14	2000	–	2649	–	170M8610
		–	1800	2237	–	170M8610

(1) 20DM820 drives (ND) are only capable of producing 95% of starting torque under 10 Hz.
(2) Not available with 700S Control.

Notes:

Lifting and Mounting Instructions

Lifting Drives

ATTENTION: To guard against possible personal injury and/or equipment damage...

- Remove any wiring access covers at the top of the drive.
- Do Not allow any part of the drive or lifting mechanism to make contact with electrically charged conductors or components.
- At no time should a person or their limbs be directly underneath the items being lifted.
- Do not subject the load to high rates of acceleration or deceleration.
- Inspect all lifting hardware for proper attachment before lifting drive unit.

- For lifting instructions for frame 9 size drives, see Lifting Frame 9 Size Drives on page B-2.
- For lifting instructions for frame 10 - 14 size drives, see Lifting Frame 10-14 Size Drives on page B-3.

Lifting Frame 9 Size Drives

Important: When lifting frame 9 drives, a rod must be placed between the lifting holes as shown in Figure B.1.

Figure B.1 Frame 9 Lifting

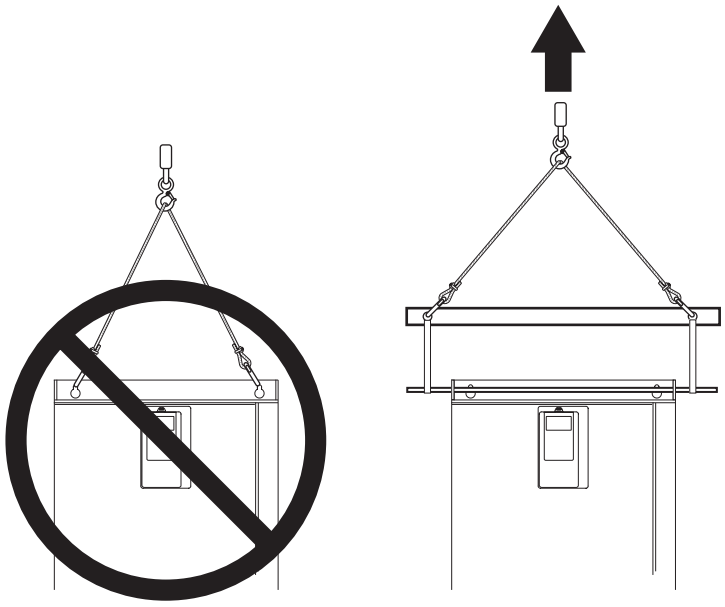


Table B.A Frame 9 - Approximate Drive and Enclosure Weights

Voltage Class	Drive Rating Amps	AC Input Drive & Enclosure Weight *kg (lbs.)*	AC Input Drive, Enclosure & Packaging Weight *kg (lbs.)*	DC Input Drive & Enclosure Weight *kg (lbs.)*	DC Input Drive, Enclosure & Packaging Weight *kg (lbs.)*
400/480V AC (540/650V DC)	261	143 (315)	205 (452)	109 (240)	171 (377)
400/480V AC (540/650V DC)	300	151 (333)	213 (470)	117 (258)	179 (395)
600/690V AC (810/932V DC)	170	143 (315)	205 (452)	109 (240)	171 (377)
600/690V AC (810/932V DC)	208	143 (315)	205 (452)	109 (240)	171 (377)

Lifting Frame 10-14 Size Drives

When lifting frame 10-14 size drives you must:

- attach the lifting hardware.
- remove the skid and shipping feet.

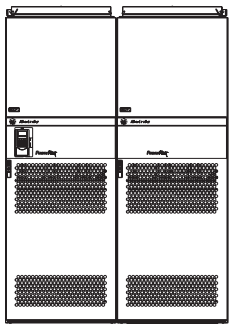
Step 1: Attaching the Lifting Hardware to the Drive

Important: AC Input frame 14 drives are shipped as multiple enclosure sections that must be lifted separately and then connected after they have been properly mounted.

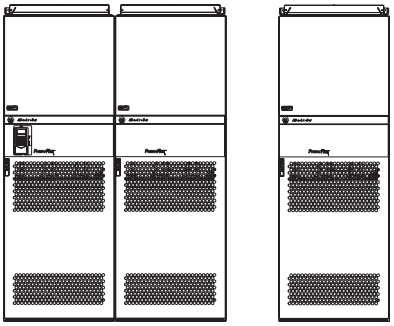
ATTENTION: Do Not lift frame 14 drive enclosure sections after they have been connected as one unit. Lifting connected frame 14 drive enclosure sections as one unit may result in a hazardous condition that could cause personal injury and/or equipment damage.

Figure B.2 Frame 14 Shipping Sections

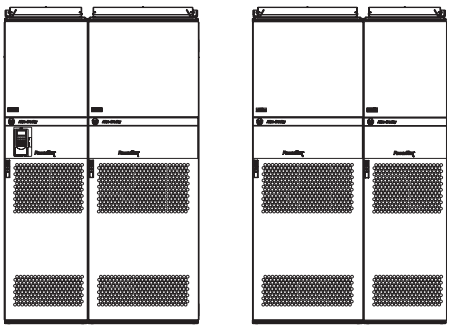
DC Input Drive - Lift as one unit.



AC Input Drive, 1500A - 2 sections shipped. Lift each enclosure section separately.



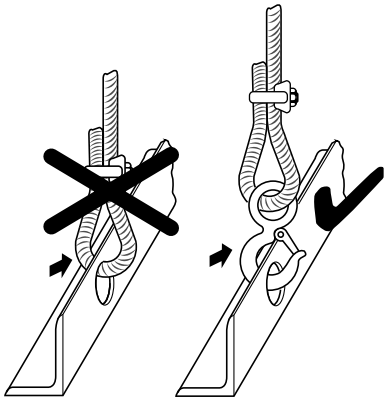
AC Input Drive, > 1500A - 2 sections shipped. Lift each enclosure section separately.



Directions for Lifting Drives in Rittal Enclosures (Codes “A” and “H”)

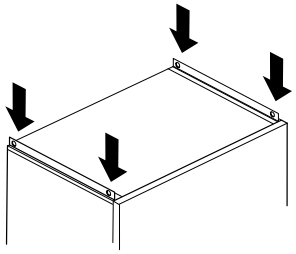
ATTENTION: Always use slings with load rated safety hooks or shackles.

A All Size Drives

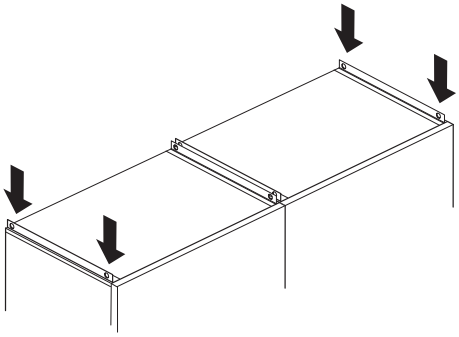


TIP: To ensure that the angle between the roof of the enclosure and the chain or cable is greater than 60°, make the length of the chain or cable between the center lifting point and the corners (B) is longer than the distance between the opposite corners (A).

B Frame 10, 11, 13 and 14 Size Drives

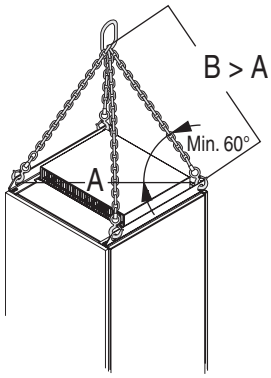


B Frame 12, 13 and 14 Size Drives



Note: Lift each Frame 14 drive enclosure section separately.

C Frame 10, 11, 13 and 14 Size Drives



C Frame 12, 13 and 14 Size Drives

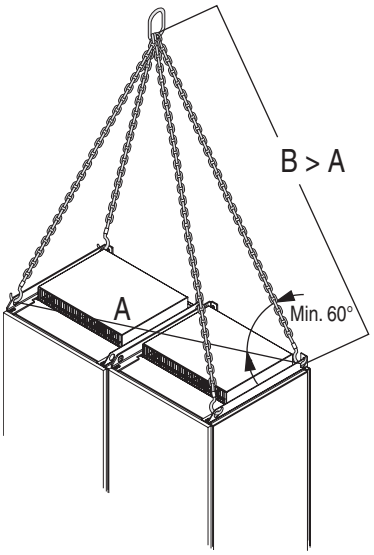


Table B.B Frame 10 - 13 Approximate Drive and Enclosure Weights

Frame Size	Voltage Class	Drive Rating Amps	AC Input Drive & Enclosure Weight *kg (lbs.)*	AC Input Drive & Packaging Weight *kg (lbs.)*	DC Input Drive & Enclosure Weight *kg (lbs.)*	DC Input Drive & Packaging Weight *kg (lbs.)*
10	400/480V AC (540/650V DC)	385	382 (842)	432 (952)	267 (589)	317 (699)
		460	382 (842)	432 (952)	267 (589)	317 (699)
		500	382 (842)	432 (952)	267 (589)	317 (699)
	600/690V AC (810/932V DC)	261	320 (705)	370 (816)	267 (589)	317 (699)
		325	351 (774)	401 (884)	267 (589)	317 (699)
		385	351 (774)	401 (884)	267 (589)	317 (699)
		416	351 (774)	401 (884)	267 (589)	317 (699)

Frame Size	Voltage Class	Drive Rating Amps	AC Input Drive & Enclosure Weight *kg (lbs.)*	AC Input Drive & Packaging Weight *kg (lbs.)*	DC Input Drive & Enclosure Weight *kg (lbs.)*	DC Input Drive & Packaging Weight *kg (lbs.)*
11	400/480V AC (540/650V DC)	590	564 (1243)	614 (1354)	396 (873)	446 (983)
		650	564 (1243)	614 (1354)	396 (873)	446 (983)
		730	564 (1243)	614 (1354)	396 (873)	446 (983)
	600/690V AC (810/932V DC)	460	511 (1127)	561 (1237)	396 (873)	446 (983)
		502	511 (1127)	561 (1237)	396 (873)	446 (983)
		590	626 (1380)	676 (1490)	396 (873)	446 (983)
12	400/480V AC (540/650V DC)	820	814 (1795)	864 (1905)	584 (1287)	634 (1398)
		920	814 (1795)	864 (1905)	584 (1287)	634 (1398)
		1030	814 (1795)	864 (1905)	584 (1287)	634 (1398)
	600/690V AC (810/932V DC)	650	752 (1658)	802 (1768)	584 (1287)	634 (1398)
		750	752 (1658)	802 (1768)	584 (1287)	634 (1398)
		820	752 (1658)	802 (1768)	584 (1287)	634 (1398)
13	400/480V AC (540/650V DC)	1150	1348 (2972)	1468 (3236)	600 (1323)	720 (1587)
		1300	1400 (3086)	1520 (3351)	600 (1323)	720 (1587)
		1450	1400 (3086)	1520 (3351)	600 (1323)	720 (1587)
	600/690V AC (810/932V DC)	920	1248 (2751)	1368 (3016)	600 (1323)	720 (1587)
		1030	1248 (2751)	1368 (3016)	600 (1323)	720 (1587)
		1180	1248 (2751)	1368 (3016)	600 (1323)	720 (1587)

Table B.C AC Input Frame 14 Approximate Drive and Enclosure Weights

Voltage Class	Drive Rating Amps	Section 1 Drive & Enclosure Weight *kg (lbs.)*	Section 1 Drive, Enclosure & Packaging Weight *kg (lbs.)*	Section 2 Drive & Enclosure Weight *kg (lbs.)*	Section 2 Drive, Enclosure & Packaging Weight *kg (lbs.)*	Total Drive & Enclosure Weight (All Sections) *kg (lbs.)*
400	1770	1120 (2469)	1240 (2733)	1120 (2469)	1240 (2733)	2240 (4938)
	2150	1150 (2535)	1270 (2799)	1150 (2535)	1270 (2799)	2300 (5071)
	2700	1920 (4233)	2040 (4497)	1920 (4233)	2040 (4497)	3840 (8466)
600	1500	1270 (2800)	1390 (3064)	650 (1433)	770 (1697)	1920 (4233)
	1900	1120 (2469)	1240 (2733)	1120 (2469)	1240 (2733)	2240 (4938)
	2250	1150 (2535)	1270 (2799)	1150 (2535)	1270 (2799)	2300 (5071)

Table B.D DC Input Frame 14 Approximate Drive and Enclosure Weights

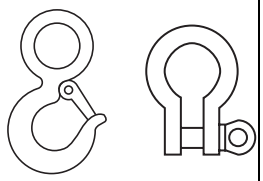
Voltage Class	Drive Rating Amps	Drive & Enclosure Weight *kg (lbs.)*	Drive, Enclosure & Packaging Weight *kg (lbs.)*
400	1770	1330 (2866)	1450 (3130)
	2150	1330 (2866)	1450 (3130)
	2700	1330 (2866)	1450 (3130)
600	1500	1220 (2690)	1340 (2954)
	1900	1330 (2866)	1450 (3130)
	2250	1330 (2866	1450 (3130)

Directions for Lifting Drives in an MCC Enclosure (Code “B”)

ATTENTION: Always use slings with load rated safety hooks or shackles.

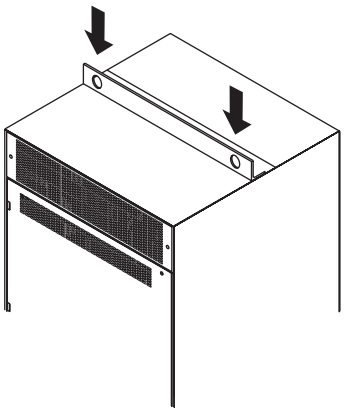
A All Size Drives

TO BE USED

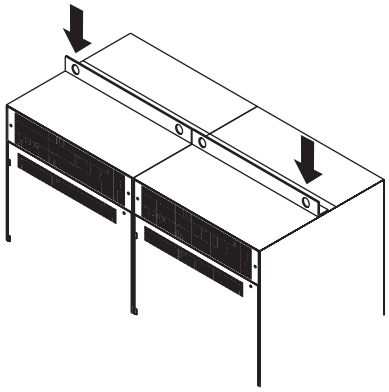


TIP: The height (of the lift point) above the lift angle should be at least one half "A" (the distance between lift holes). This assures an angle of less than 45° with the vertical.

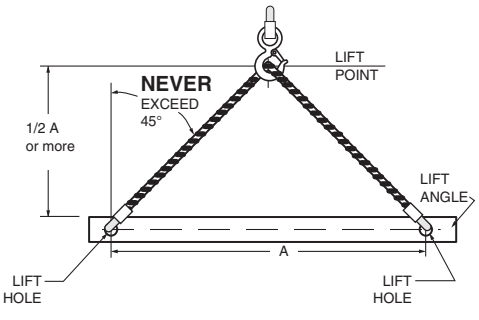
B Frame 10 and 11 Size Drives



B Frame 12 Size Drives



C Frame 10 and 11 Size Drives



C Frame 12 Size Drives

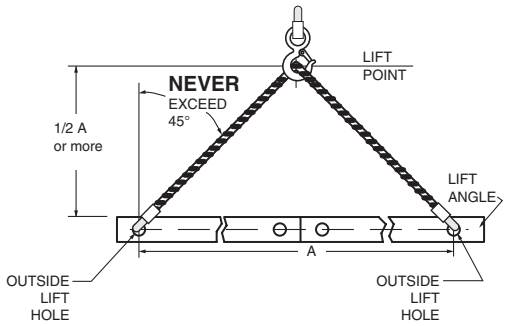
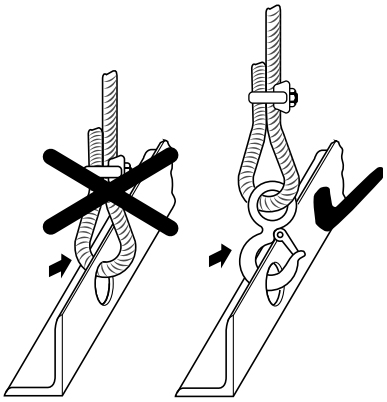


Table B.E Frame 10 - 12 Approximate Drive and MCC Style Enclosure (Code “B”) Weights

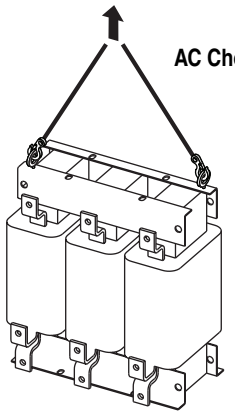
Frame	Voltage Class	Drive Rating Amps	Drive & Enclosure Weight *kg (lbs.)*	Drive, Enclosure & Packaging Weight *kg (lbs.)*
10	400V AC	385 - 500	454 (1100)	522 (1150)
	600V AC	261-416	449 (990)	480 (1058)
11	400 V AC	590 - 730	696 (1535)	719 (1585)
	600 V AC	460 - 590	640 (1411)	661 (1457)
12	400 V AC	820 - 1030	966 (2130)	989 (2180)
	600 V AC	650 - 820	888 (1958)	909 (2003)

Directions for Lifting NEMA/UL Type 1, IP00/Open Drives (Code "N")

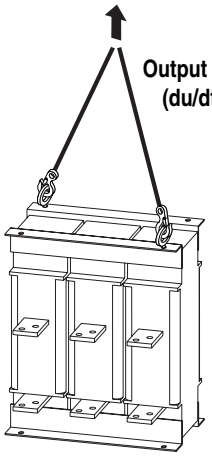
A **All Size Drives**



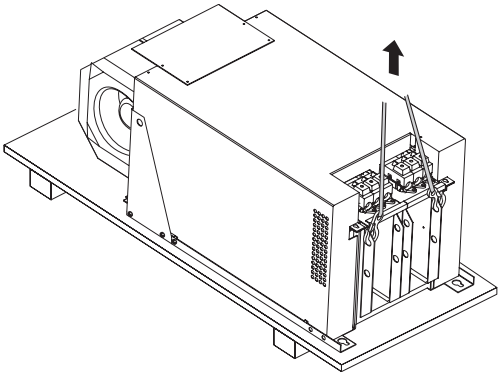
B **All Size Drives**



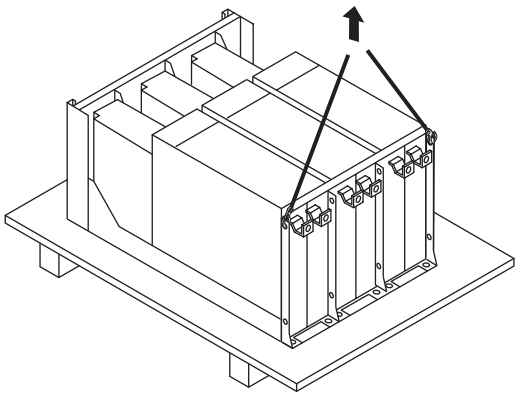
B **Frame 14 Drives**



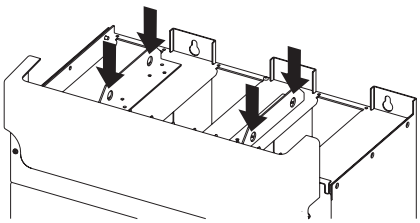
C **Frame 10, 11 and 12 Size Drives**



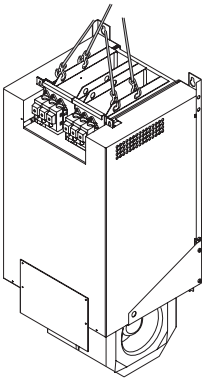
C **Frame 13 and 14 Size Drives**



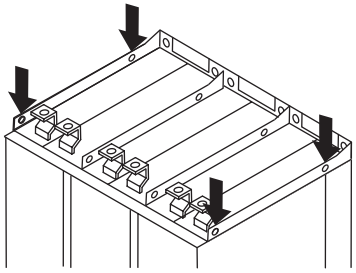
D **Frame 10, 11 and 12 Size Drives**



Fasten the module symmetrically in at least two (2) holes.



D **Frame 13 and 14 Size Drives**



Fasten the module symmetrically in at least two (2) holes.

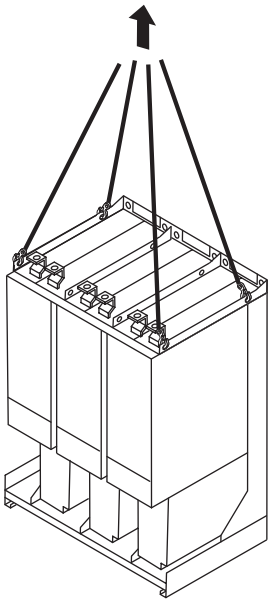


Table B.F Frames 10 - 12 Open Type Drives - Approximate Weights

Frame Size	Drive Voltage Class	Drive Rating Amps	Power Structure Weight *kg (lbs.)*	AC Choke Weight *kg (lbs.)*	AC Input Drive & Packaging Weight *kg (lbs.)*[4]
10	400	385	120 (265)	115 (254)	235 (519)
		460	120 (265)	115 (254)	235 (519)
		500	120 (265)	115 (254)	235 (519)
	600	261	120 (265)	53 (117)	173 (382)
		325	120 (265)	84 (185)	204 (450)
		385	120 (265)	84 (185)	204 (450)
		416	120 (265)	84 (185)	204 (450)
11	400	590	210 (463)	84 (185)[2]	378 (833)
		650	210 (463)	84 (185)[2]	378 (833)
		730	210 (463)	84 (185)[2]	378 (833)
	600	460	210 (463)	115 (254)	325 (717)
		502	210 (463)	115 (254)	325 (717)
		590	210 (463)	115 (254)[2]	440 (970)
12	400	820	120 (265)[1]	115 (254)[3]	350 (772)
		920	120 (265)[1]	115 (254)[3]	350 (772)
		1030	120 (265)[1]	115 (254)[3]	350 (772)
	600	650	120 (265)[1]	84 (185)[3]	288 (635)
		750	120 (265)[1]	84 (185)[3]	288 (635)
		820	120 (265)[1]	84 (185)[3]	288 (635)

(1) Two power structures are required per frame 12 Drive
(2) Two AC chokes are required for this frame 11 AC Drive
(3) Two AC chokes are required per frame 12 AC Drive
(4) DC input drive and packaging weight is equal to the weight of the power structure(s)

Table B.G Frame 13 Open Type Drives - Approximate Weights

Drive Voltage Class	Drive Rating Amps	Power Module Weight *kg (lbs.)*	AC Choke Weight *kg (lbs.)*	NFE Module Weight *kg (lbs.)*
400	1150	306 (675)	130 (287)[1]	67 (148)[1]
	1300	306 (675)	115 (254)[2]	67 (148)[2]
	1450	306 (675)	115 (254)[2]	67 (148)[2]
600	920	306 (675)	130 (287)[1]	67 (148)[1]
	1030	306 (675)	130 (287)[1]	67 (148)[1]
	1180	306 (675)	130 (287)[1]	67 (148)[1]

(1) Two AC chokes and NFE (Non-Regenerative Front-End) Modules are required for this frame 13 AC drive
(2) Three AC chokes and NFE Modules are required for this frame 13 AC drive

Table B.H Frame 14 Open Type Drives - Approximate Weights

Drive Voltage Class	Drive Rating Amps	Power Module Weight *kg (lbs.)*	AC Choke Weight kg (lbs.)	NFE Module Weight *kg (lbs.)*	Output Reactor (du/dt Filter) *kg (lbs.)*[4]
400	1770	306 (675)	115 (254)[1]	67 (148)[1]	160 (353)
	2150	306 (675)	130 (287)[1]	67 (148)[1]	160 (353)
	2700	306 (675)	115 (254)[2]	67 (148)[2]	160 (353)
600	1500	306 (675)	115 (254)[3]	67 (148)[3]	120 (265)
	1900	306 (675)	115 (254)[1]	67 (148)[1]	160 (353)
	2250	306 (675)	130 (287)[1]	67 (148)[1]	160 (353)

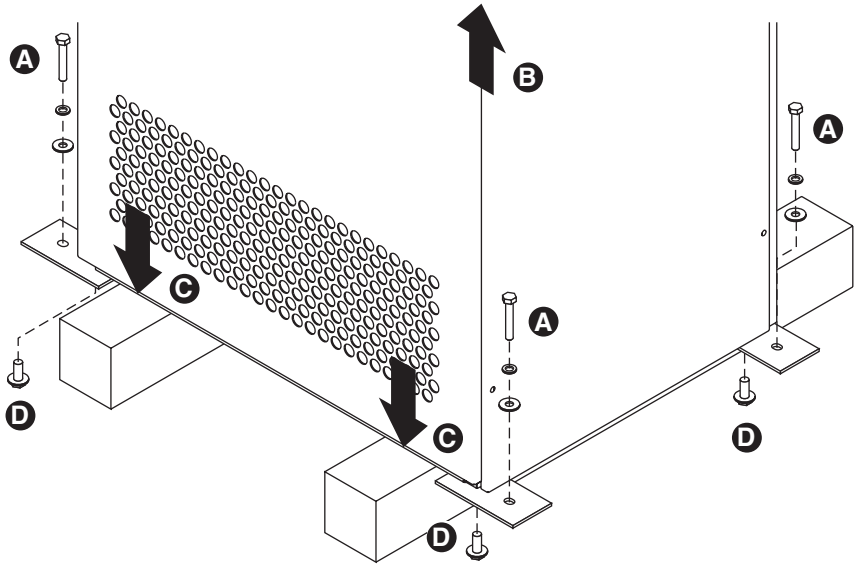
(1) Four AC chokes and NFE Modules are required for this frame 14 AC drive
(2) Six AC chokes and NFE Modules are required for this frame 14 AC drive
(3) Three AC chokes and NFE Modules are required for this frame 14 AC drive
(4) Two du/dt filters are required per frame 14 AC drive

Step 2: Removing the Skid and Shipping Feet for Frame 10 - 14 Enclosures

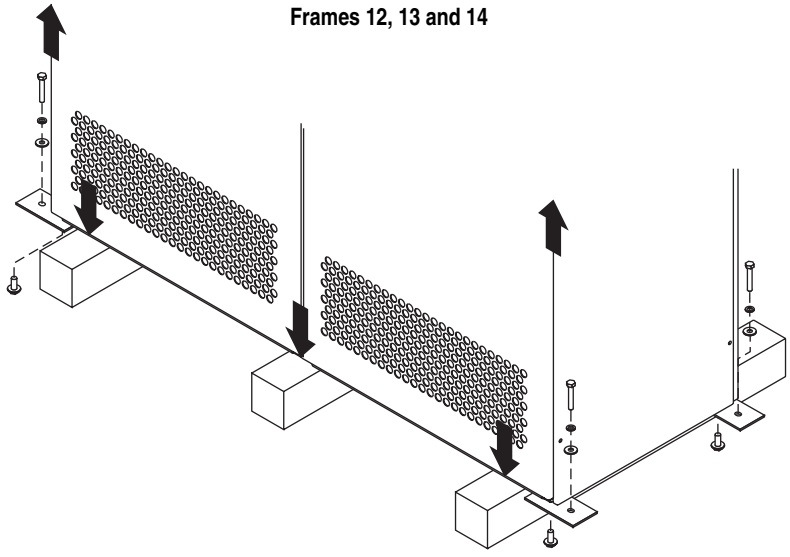
ATTENTION: To guard against personal injury and equipment damage, do not work under the drive unless the drive is securely mounted on appropriate blocks.

Task	Description
A	Using a 15 mm wrench, remove the hardware that secures the drive to the skid.
B	Lift the drive off of the skid.
C	Place the drive on the proper blocks on a hard level surface. The blocks should be approximately 10 cm (4 inches) high.
D	Using a 17 mm wrench, remove the hardware that secures the feet to the drive and remove the feet.

Frames 10, 11, 13 and 14 (Frame 13 and 14 single enclosures only)

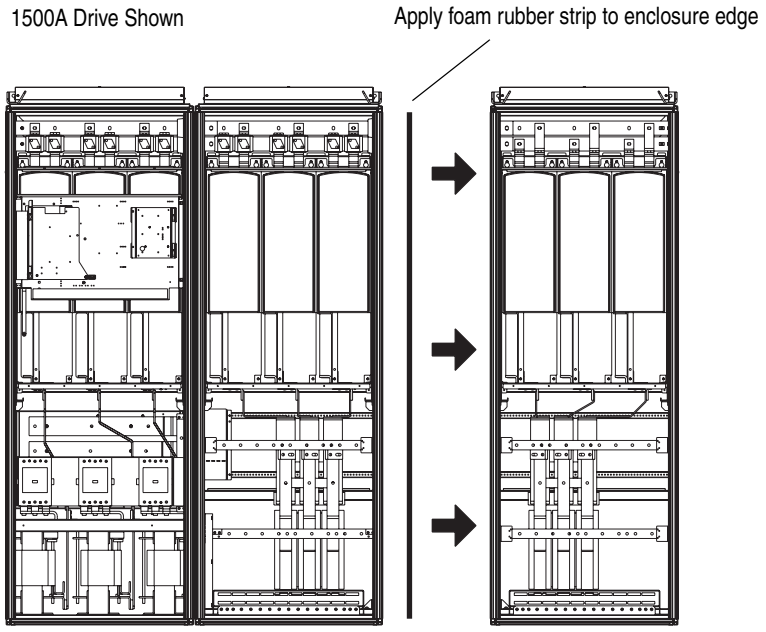


Frames 12, 13 and 14

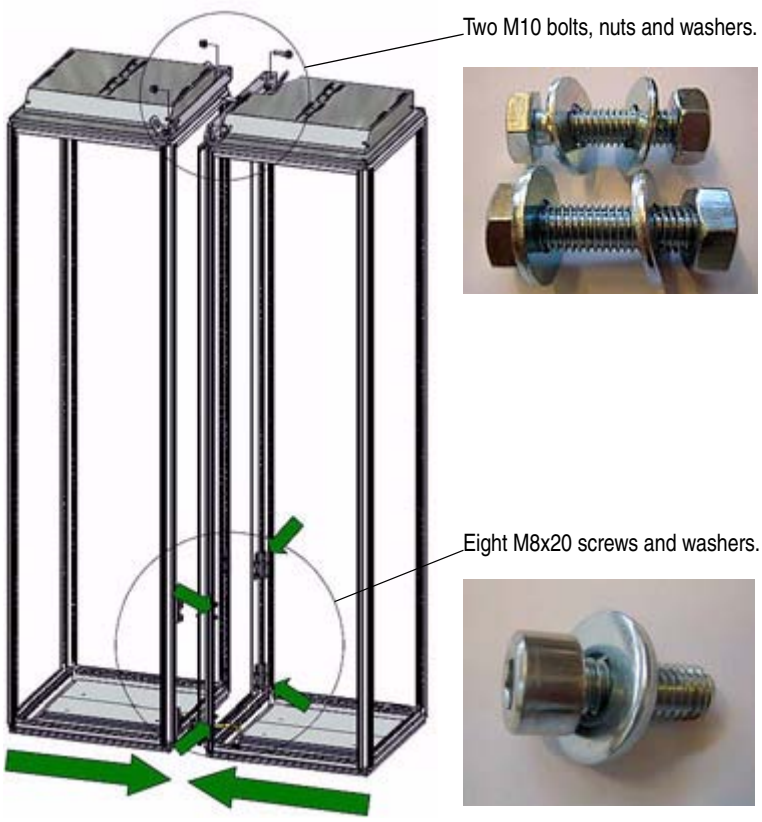


Step 3: Mounting Frame 10 - 14 Drive Enclosures to the Floor and/or Wall

1. For AC input frame 14 drives only, secure the foam rubber strip supplied with the drive to the edge of one of the open-sided drive enclosure sections.



2. For AC input frame 14 drives only, verify that the holes on the lifting angles and the four metal connecting plates mounted to the rails between the enclosures are properly aligned and secure the enclosure sections using the bolts, washers, nuts and screws provided.



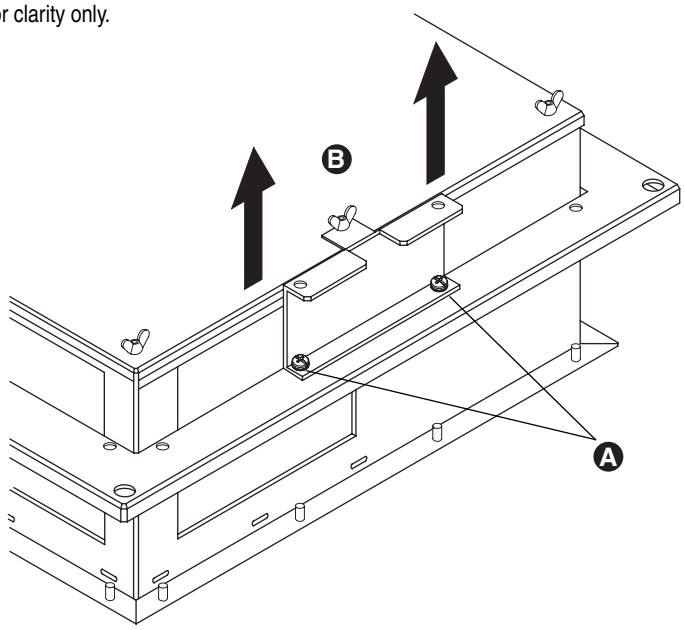
Note: Enclosure panels not shown for clarity only.

3. Drives installed in a NEMA/UL Type 12 IP54 enclosure (PowerFlex 700H Control only) are shipped with the roof assembly installed at a reduced height for shipping purposes. The roof assembly must be installed at its full height before starting the drive. Follow the steps below to install the roof assembly.

Note: The NEMA/UL Type 12 IP54 enclosure roof assembly is provided with the required filters installed.

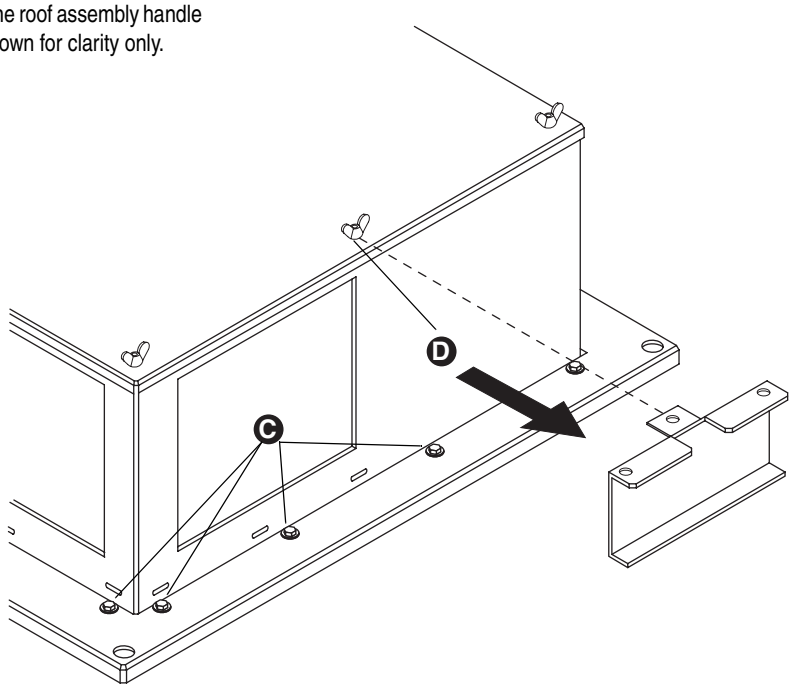
Task	Description
Ⓐ	Remove the two sheet metal screws that secure each of the two roof assembly handles to the roof panel.
Ⓑ	Lift the roof assembly into place, using the handles provided.

One roof assembly handle shown for clarity only.



Task	Description
Ⓒ	Secure the roof assembly to the roof panel using the 16 washers and screws provided to .
Ⓓ	Remove the two wing nuts that hold the handles in place, remove the two handles and replace the wing nuts.

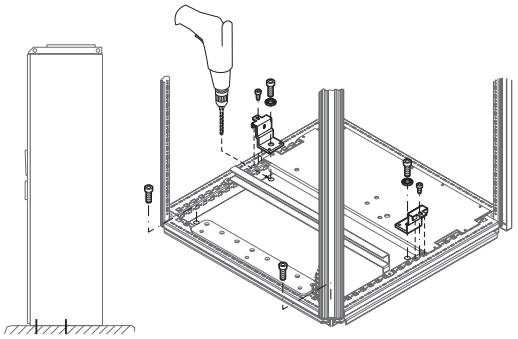
One roof assembly handle shown for clarity only.



4. Complete the appropriate mounting procedures for Floor Mounting (below) and/or Wall Mounting on page B-14:

Floor Only Mounting

Secure the drive to the floor with anchor bolts in the front corner holes of the enclosure base plate. Additionally secure the drive using the mounting plates as needed (Rittal part no. 8800-210 or equivalent). Do this as far back as possible to the choke assembly plate. With this method the holes through base plate must be drilled on-site.

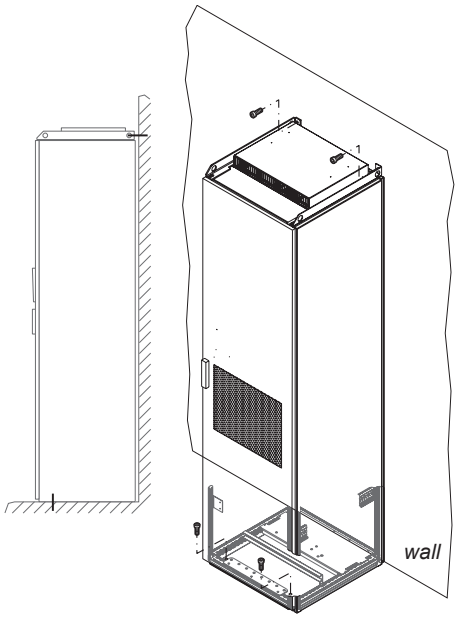


Important: If it is important to align the drive cabinet vertically with adjacent Rittal cabinets, you may need to place shims under the drive cabinet or use leveling feet throughout the cabinet

line-up. The Allen-Bradley factory may have removed the standard plastic plugs from the bottom of the cabinet when installing the shipping feet. This reduces the height of the cabinet by 2 mm.

Wall Mounting

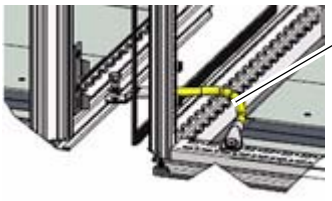
Secure drive to the floor with anchor bolts in the front corner holes of the enclosure base plate. Secure the drive by bolting the adjustable lifting rails to the rear wall or supporting structure.



If you are installing a Frame 14 drive, continue with Step 4: Connecting Frame 14 Enclosure Sections on page B-15.

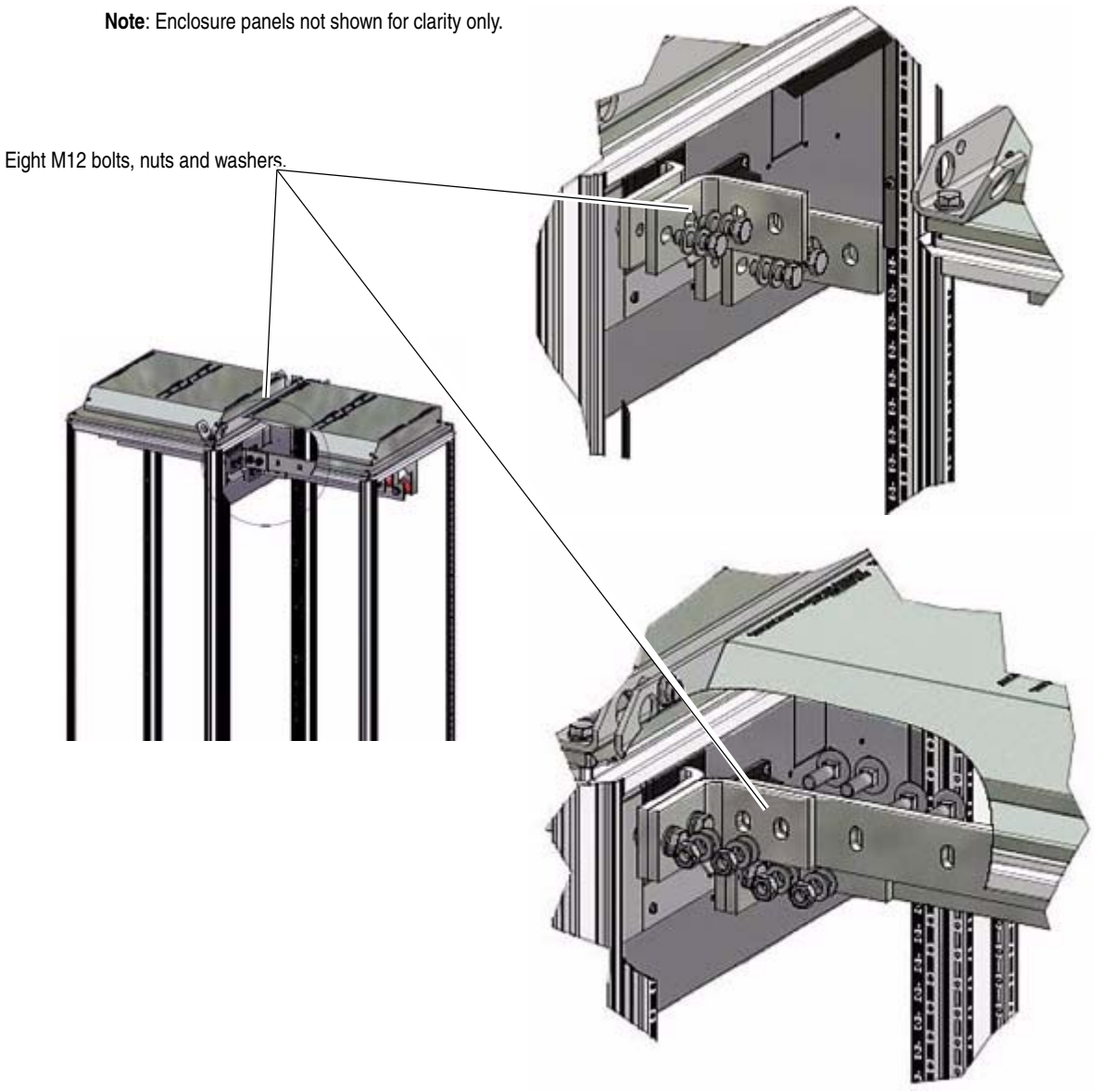
Step 4: Connecting Frame 14 Enclosure Sections

1. Secure the cable connected to the PE bar on one enclosure to the PE bar on the second enclosure using the screw provided.

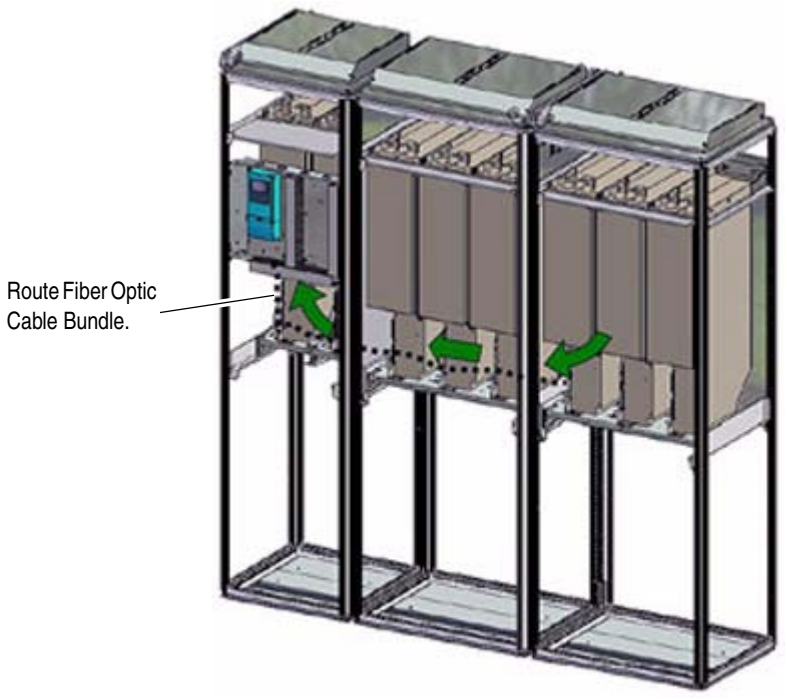


2. Secure the L-shaped bus bars to the main bus bars at the top of the enclosures with the M12 bolts, washers and nuts provided. Tightening torque is 70N•m (619.5 lb.•ft.).

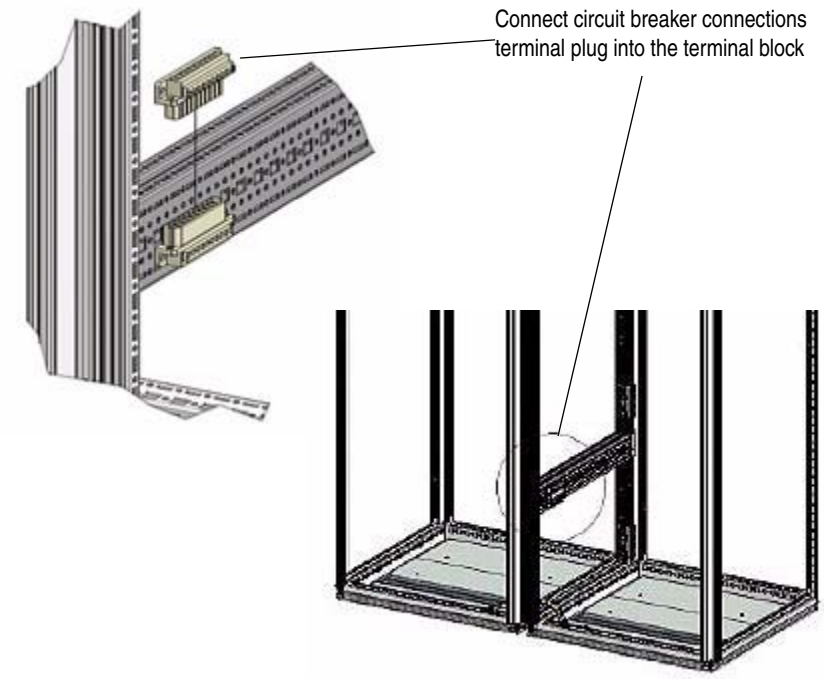
Note: Enclosure panels not shown for clarity only.



3. Route the fiber optic cables from the Power Structure (right-hand enclosure) to control pan and connect the cables to the 700S Fiber Optic Interface board on the back of the control plate or the 700H Star Coupler board on the back of the control frame.



4. For frame 14 drives rated above 1500 Amps, route the circuit breaker control cables and terminal plug from the right-hand enclosure and connect it to the terminal block on the enclosure frame.



PowerFlex 700S Hi-Resolution (Stegmann) Encoder Feedback Option

Specifications

Hi-Resolution (Stegmann) Feedback Option Card Specifications

Consideration	Description
Encoder Voltage Supply	11.5V dc @ 130 mA
Stegmann Feedback	Sine/Cosine 1V P-P Offset 2.5
Maximum Cable Length	90m (295 ft)
Maximum Frequency (Encoder Speed)	12.5 µs/cycle (4687.5 RPM for encoders with 1024 sine cycles per revolution) (9375 RPM for encoders with 512 sine cycles per revolution)
RS-485 Interface	The Hi-Resolution Feedback Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up: • Address • Command Number • Mode • Number of turns • Number of Sine/Cos cycles • Checksum
Customer-I/O plug (P1)	Allen-Bradley PN: S94262912 Weidmuller PN: BL3.50/90/12BK

Supported Encoders

Table C.A specifies which encoders are supported by the 700S Hi-Resolution Stegmann Encoder Feedback Option module.

Important: Please note that encoders must be ordered as "Single Ended". This will ensure that the RS-485 channel has the proper termination network installed at the factory.

Table C.A Supported Stegmann Encoders

Model	Resolution	Comment
SINCOS® SCS-60, SCS-70, SCM-60, and SCM-70	512 sine cycles per revolution.	SCM-60 and SCM-70 have built-in mechanical turns counter.
SINCOS® SCS-KIT-101 and SCM-KIT-101	1024 sine cycles per revolution.	SCM-60 and SCM-70 have built-in mechanical turns counter.
SINCOS® SRS-50, SRS-60, SRM-50, and SRM-60	1024 sine cycles per revolution.	SRM-50 and SRM-60 have built-in mechanical turns counter.
SINCOS® SRS/M 25	1024 sine cycles per revolution	SRS25 and SRM25 have built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting.

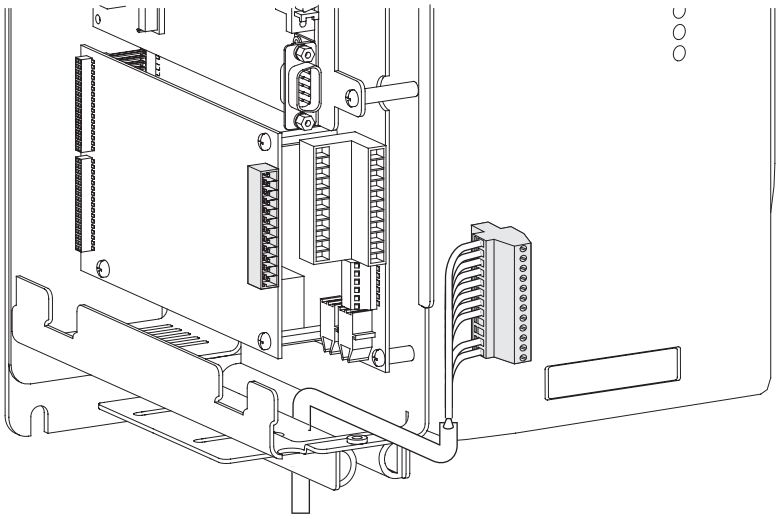
Model	Resolution	Comment
SINCOS® SRS660	1024 sine cycles per revolution	Hollow-shaft up to 14 mm diameter
SINCOS® SHS-170	512 sine cycles per revolution.	While the software supports this encoder, the SHS-170 draws excessive current and should only be used with an external power supply.
Allen-Bradley 842HR	1024 sine cycles per revolution	Has built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting.

SINCOS®, SINCODER® and LINCODER® are registered trademarks of Stegmann Inc.

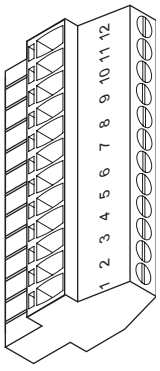
Wiring the Hi-Resolution Feedback Option Card to an Encoder

Terminal block P1 contains connection points for a Stegmann Hiperface® encoder. This terminal block resides on the Hi-Resolution Encoder Feedback Option card.

Hiperface® is a registered trademark of Stegmann Inc.



TIP: Remember to route wires through the sliding access panel at the bottom of the Control Assembly.



Terminal	Signal	Description
12	POWER COMMON	Power supply for encoder interface.
11	POWER	
10	REFSIN	Negative Sine signal.
9	+SIN	Positive Sine signal.
8	REFCOS	Negative Cosine signal.
7	+COS	Positive Cosine signal.
6	SHIELD	Connection point for encoder cable shield.
5	SHIELD	
4	N/C	Not connected.
3	N/C	
2	DATA+ (RS 485)	Positive DH485 terminal.
1	DATA- (RS 485)	Negative DH485 terminal.

Recommended Cables

If you are using this motor and feedback device:	Use this cable:	See this wiring diagram:
Allen-Bradley 1326AB-BXXXX-21ML, and -21MKXL motors with embedded Stegmann rotary encoder	Allen-Bradley 1326-CECU-XXL-XXX	Figure C.1 on page C-4
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure C.2 on page C-4
Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure C.2 on page C-4
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure C.3 on page C-4
Allen-Bradley MPL-A5xx and all MPL-Bxxx motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure C.3 on page C-4
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure C.4 on page C-5
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-UXNFDMP-SXX	Figure C.5 on page C-5
Any other motor with external Stegmann SHS-170 rotary encoder	Stegmann shielded twisted-pair cable with 12-pin DIN style connector	Figure C.6 on page C-5
Any other motor with external Stegmann SCS-60, SCS-70, SCM-60 or SCM-70, SRS-50, SRS-60, SRM-60, SRM-60, SRS-25, SRM-25 or Allen-Bradley 842HR rotary encoder	Stegmann shielded twisted-pair cable with 10-pin MS style connector	Figure C.7 on page C-6
Any other motor with external Stegmann SCS-Kit 101 or SCK-Kit 101 rotary encoder	Stegmann shielded twisted-pair cable with 8-pin Berg style connector	Figure C.8 on page C-6
Any other motor with external Stegmann SRS660 rotary encoder	Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths	Figure C.9 on page C-6

Connection Examples

Figure C.1 1326AB-BXXXX-21ML, and -21MKXL motors with a 1326-CECU-XXL-XXX cable

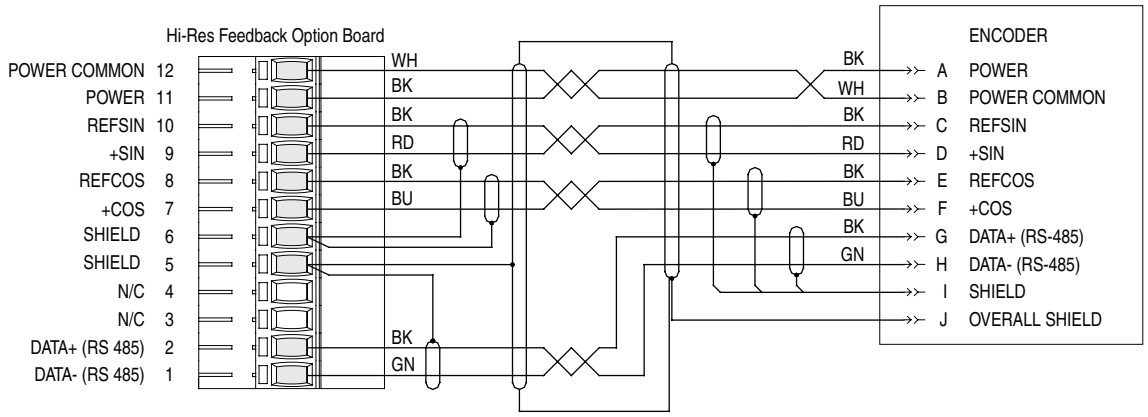


Figure C.2 MPL-A5xx and all MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable

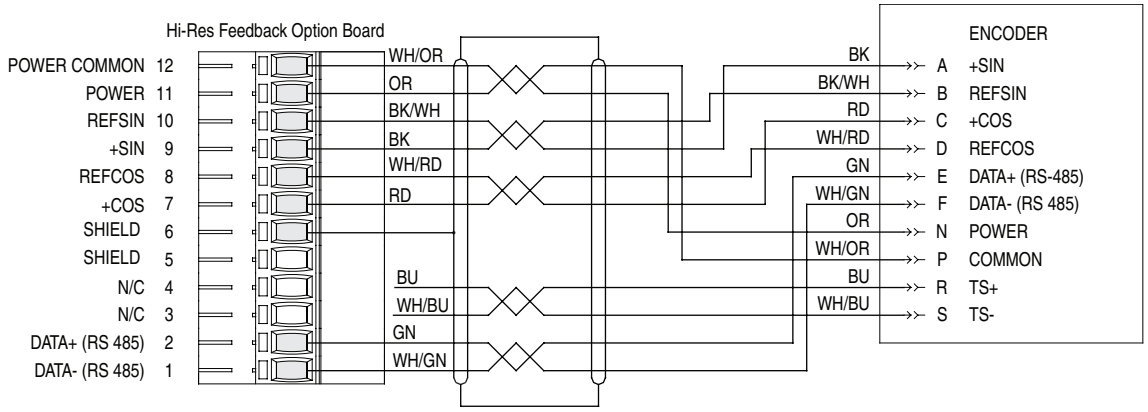
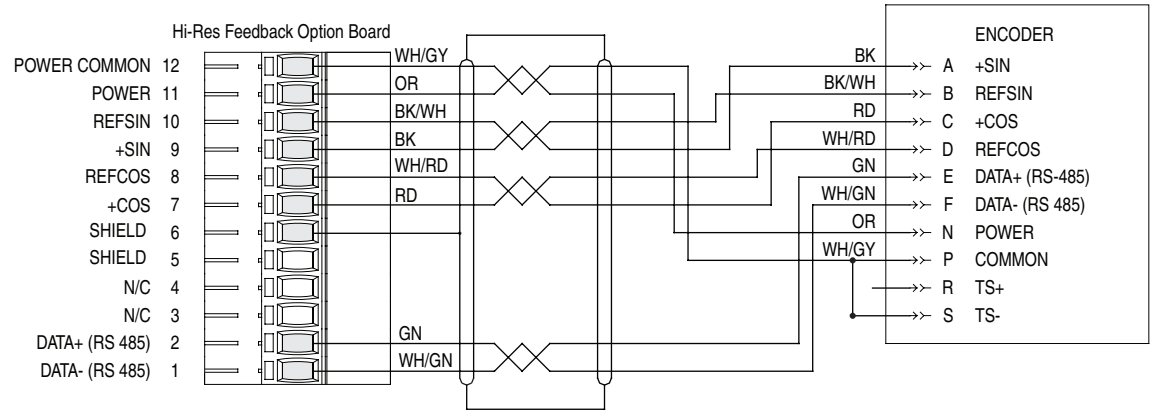


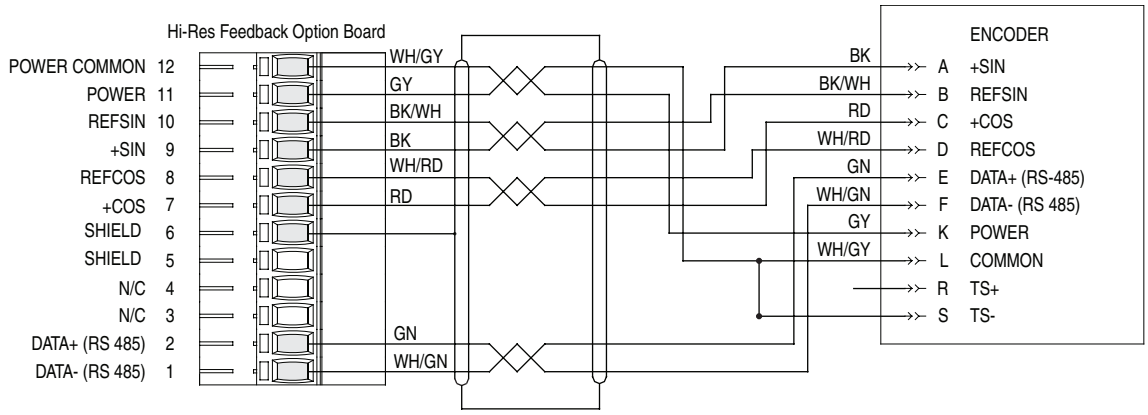
Figure C.3 MPL-A5xx and all MPL-Bxxx Motor or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motor with 2090-XXNFMP-SXX cable



Note: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

Connection Examples

Figure C.4 MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-XXNFMP-SXX cable



Note: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

Figure C.5 MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable

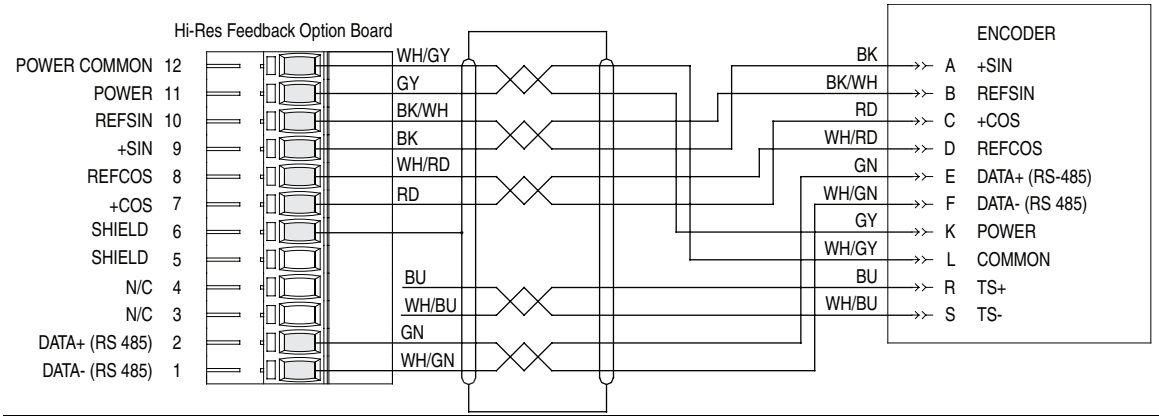
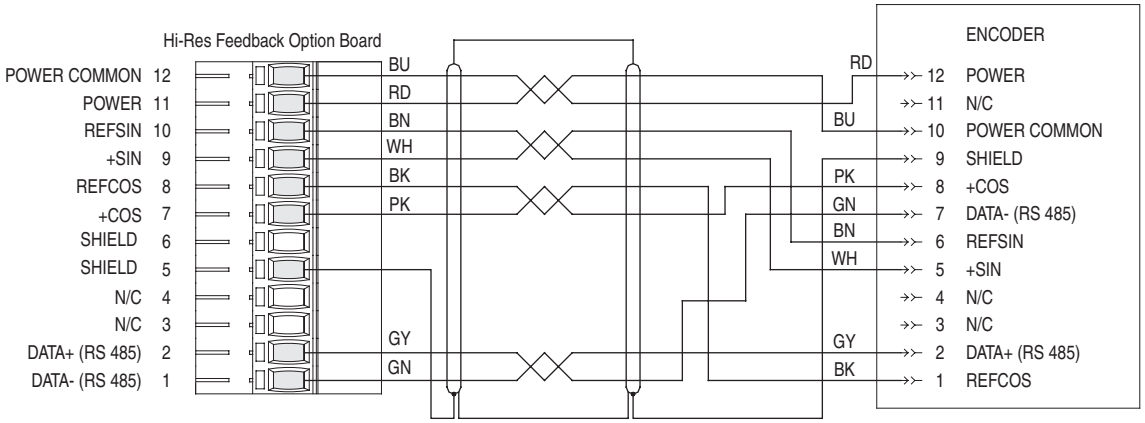


Figure C.6 Stegmann shielded twisted-pair cable with 12-pin DIN style connector



Connection Examples

Figure C.7 Stegmann shielded twisted-pair cable with 10-pin MS style connector

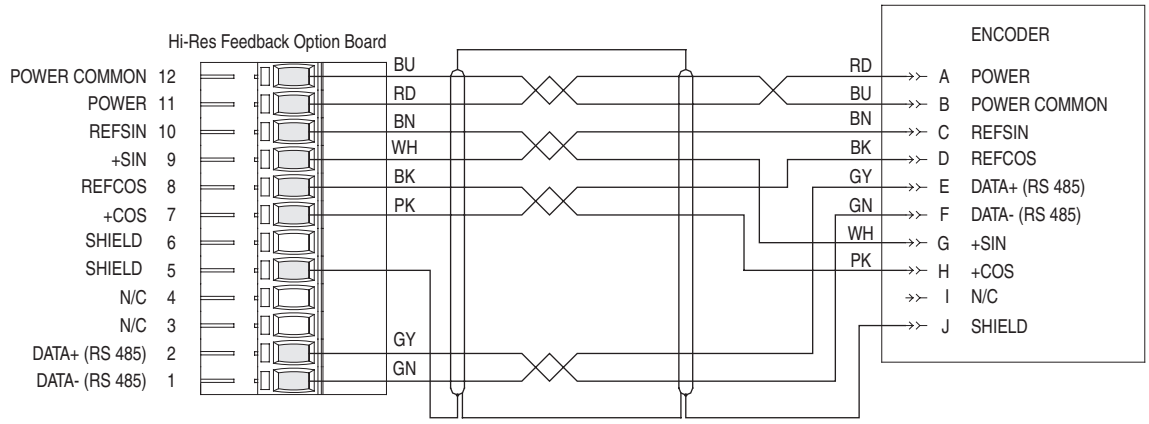


Figure C.8 Stegmann shielded twisted-pair cable with 8-pin Berg style connector

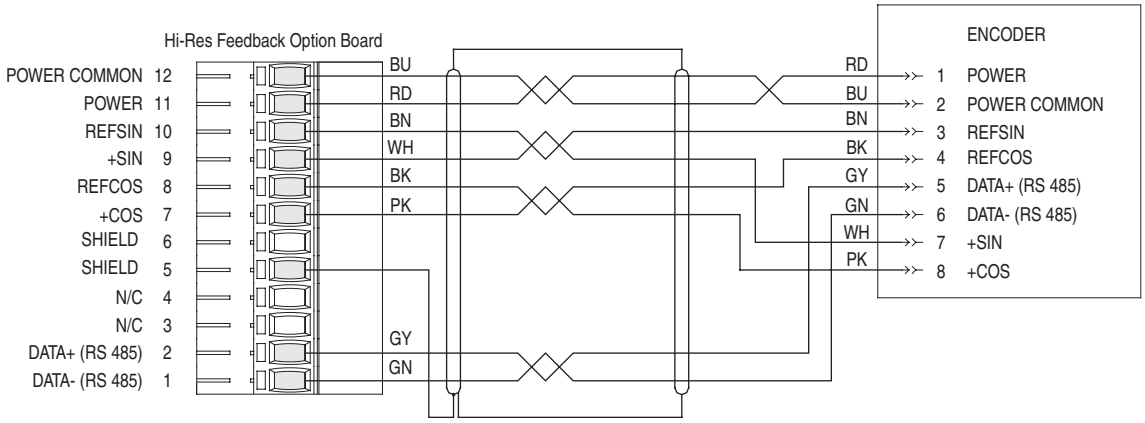
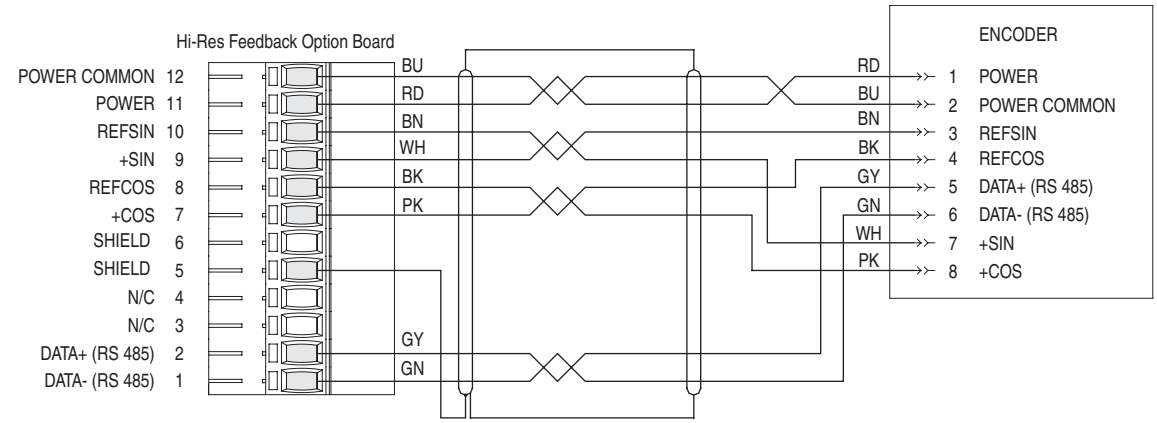


Figure C.9 Pre-attached Stegmann shielded twisted-pair cable



PowerFlex 700S Resolver Feedback Option Card

Specifications

Resolver Feedback Option Card Specifications

Consideration	Description
Excitation Frequency	2381-9300 Hz
Excitation Voltage	8-26 Vrms
Resolver Feedback Voltage	2 Vrms +/- 300 mV
Customer-I/O plug (P1)	Allen-Bradley PN: S94262908 Weidmuller PN: BL3.50/90/8BK

Compatible Resolvers

Table A specifies which resolvers are supported by the 700S Resolver Feedback Option module.

Table A Compatible Resolvers

Manufacturer	Manufacturer Catalog Number	Notes	Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 1.17	Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 2.XX
Tamagawa	TS-2014N181E32	x 1, flange-mounted enclosure	1 - Rel800123-2R	1 - T2014/2087x1
Tamagawa	TS-2014N182E32	x 2, flange-mounted enclosure	2 - Rel800123-2S	2 - T2014/2087x2
Tamagawa	TS-2014N185E32	x 5, flange-mounted enclosure	3 - Rel800123-2T	3 - T2014/2087x2
Tamagawa	TS-2087N12E9	x 2, HD foot-mounted enclosure, double shaft	2 - Rel800123-2S	2 - T2014/2087x2
Tamagawa	TS-2087N1E9	x 1, HD foot-mounted enclosure	1 - Rel800123-2R	1 - T2014/2087x1
Tamagawa	TS-2087N2E9	x 2, HD foot-mounted enclosure	2 - Rel800123-2S	2 - T2014/2087x2
Tamagawa	TS-2087N5E9	x 5, HD foot-mounted enclosure	3 - Rel800123-2T	3 - T2014/2087x2
Tamagawa	TS-2087N11E9	x 1, HD foot-mounted enclosure, double shaft	1 - Rel800123-2R	1 - T2014/2087x1
Advanced Micro Controls Inc. (AMCI)	R11X-C10/7		N/A	14 - AmciR11XC107

Allen-Bradley servo motors may be ordered with factory installed resolvers. Table B specifies which factory installed resolvers are supported by the 700S Resolver Feedback Option module.

Table B Compatibility with Resolvers on Allen-Bradley Motors

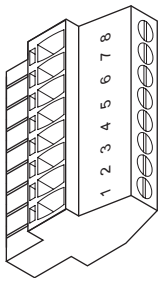
Motor / Resolver Type	Compatible	Notes	Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 1.17	Parameter 275 [Reslvr0 Type Sel] Setting for Phase I Firmware 2.XX	Parameter 277 [Reslvr0 Type Sel] Setting for Phase II Firmware 1.XX
1326 AB 230V Primary Resolver	No	Receiver type resolver - not supported	Not Supported	Not Supported	Not Supported
1326 AB 460V Primary Resolver	Yes	Transmitter type resolver - supported	9 - AB 164982-8	9 - 1326Ax 460v	9 - 1326Ax 460v
1326 AB 460V Secondary Resolver	Yes	• Secondary resolver is geared to motor - not intended for motor speed / position feedback • Transmitter type resolver - supported	13 - AB 129214-8	13 - Reserved	13 - Reserved
1326AD 230V Rare Earth Primary Resolver	No	Receiver type resolver - not supported	Not Supported	Not Supported	Not Supported
1326AH 460V Explosion Proof Motor Primary Resolver	Yes	Transmitter type resolver - supported	9 - AB 164982-8	9 - 1326Ax 460v	9 - 1326Ax 460v
1326AH 460V Explosion Proof Motor Secondary Resolver	Yes	• Secondary resolver is geared to motor - not intended for motor speed / position feedback • Transmitter type resolver - supported	N/A	N/A	N/A
1326AS 460V Rare Earth Primary Resolver	Yes	Transmitter type resolver - supported	9 - AB 164982-8	9 - 1326Ax 460v	9 - 1326Ax 460v
MPL 460V Primary Resolver	Yes	Transmitter type resolver - supported	4 - AB 155407-8	4 - MPL 460v	4 - MPL 460v

Recommended Cable

Rockwell Automation strongly recommends the use of Reliance Electric 417900-207CG or Belden 9730 cable for installation, or an equivalent cable that meets these specifications:

- 3 Twisted Pairs, 80°C, 300V
- Chrome FPR Jacket, Plenum Rated
- Conductor Size: 18 AWG
- Twists Per Inch: 2-3 twists per inch of wire lay per pair
- Capacitance Per Pair: not to exceed 30 pF per foot +/- 0.3 pF as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Capacitance Difference Pair to Pair: not to exceed 0.6 pF per foot as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Resistance per 1000 Feet: 17.15Ω +/- 10%
- Inductance per 1000 Feet: 0.13 mH +/- 10% as read on a GEN_RAD Model 1658 RLC Digibridge or equivalent
- Insulation Thickness: 0.008 in.
- Conductor Stranding 16/30
- Jacket Thickness: 0.018 in.

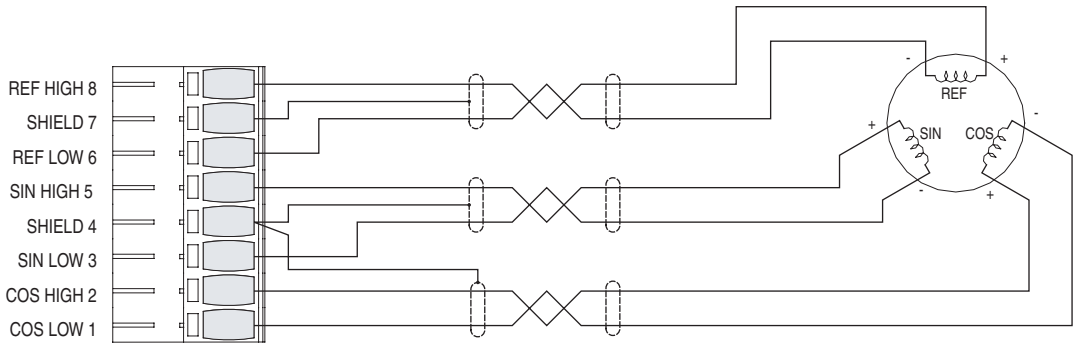
Wiring the Resolver Feedback Option Card to a Resolver



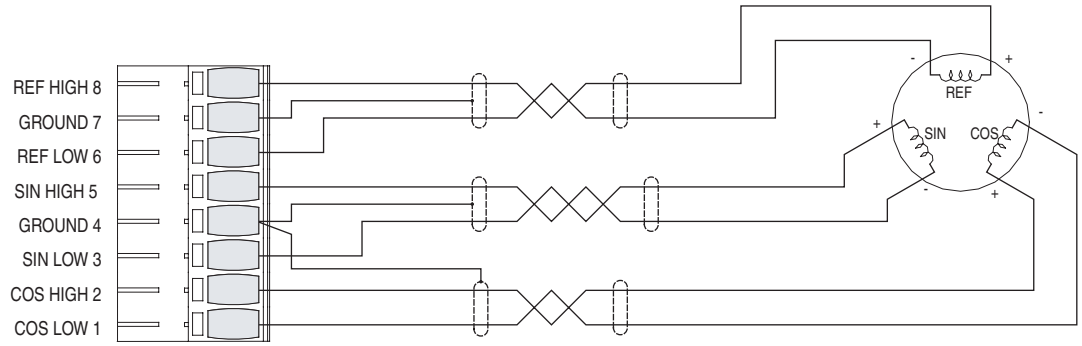
Terminal	Signal	Description
8	REF HIGH	Positive Reference signal
7	SHIELD	Connection point for resolver cable shield
6	REF LOW	Negative Reference signal
5	SIN HIGH	Positive Sine signal
4	SHIELD	Connection point for resolver cable shield
3	SIN LOW	Negative Sine signal
2	COS HIGH	Positive Cosine signal
1	COS LOW	Negative Cosine signal

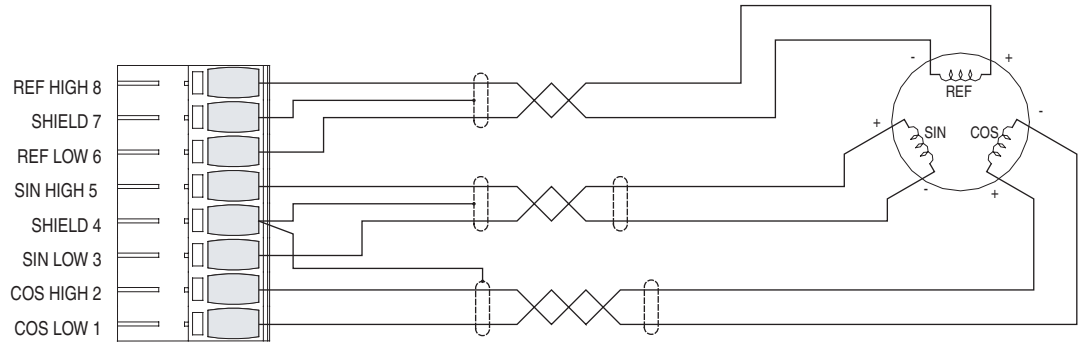
Connection Examples

Resolver Interface - Clockwise Rotation = Count Up



Resolver Interface - Clockwise Rotation = Count Down (Reverse Polarity of Sine or Cosine Signals)





PowerFlex 700S Multi-Device Interface Option Card

Specifications

MDI Option Card Specifications

Consideration	Description
Rotary Encoder Voltage Supply	11.5V dc @ 130 mA
Rotary Encoder Hi-Resolution Feedback	Sine/Cosine 1V P-P Offset 2.5
Rotary Encoder Maximum Cable Length	90m (295 ft.)
Linear Encoder Maximum Cable Length	245m (800 ft.)
Rotary Encoder RS-485 Interface	The MDI Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up: • Address • Command Number • Mode • Number of turns • Number of Sine/Cos cycles • Checksum
Registration Inputs	high speed 12-24V DC sinking digital inputs
Customer-I/O plug (P1)	Allen-Bradley PN: S94274917 Weidmuller PN: 67601782

Supported Linear Sensors

Temposonics® R-Series Linear sensors with MTS® part numbers ending in 1S2G1102 work with the MDI Option.

Part Number Character	Characteristic
1	Input Voltage = +24VDC
S	SSI output
2	Data Length = 24 Bits
G	Output Format = Gray Code
1	Resolution = 0.005 mm
1	Performance = Standard
02	Scale Orientation = Forward-acting Synchronized

Temposonics® is a registered trademark of MTS Systems Corporation.

Supported Rotary Encoders

Please note that encoders must be ordered as "Single Ended". This will ensure that the RS-485 channel has the proper termination network installed at the factory.

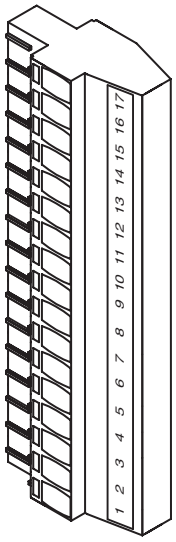
Model	Resolution	Comment
SINCOS® SCS-60, SCS-70, SCM-60, and SCM-70	512 sine cycles per revolution.	SCM-60 and SCM-70 have built-in mechanical turns counter.
SINCOS® SCS-KIT-101 and SCM-KIT-101	1024 sine cycles per revolution.	SCM-60 and SCM-70 have built-in mechanical turns counter.
SINCOS® SRS-50, SRS-60, SRM-50, and SRM-60	1024 sine cycles per revolution.	SRM-50 and SRM-60 have built-in mechanical turns counter.
SINCOS® SRS/M 25	1024 sine cycles per revolution	SRS25 and SRM25 have built-in mechanical turns counter. IP65 Protection Class. Size 25 square flange mounting.
SINCOS® SRS660	1024 sine cycles per revolution	Hollow-shaft up to 14 mm diameter
SINCOS® SHS-170	512 sine cycles per revolution.	While the software supports this encoder, the SHS-170 draws excessive current and should only be used with an external power supply.

SINCOS®, SINCODER® and LINCODER® are registered trademarks of Stegmann Inc.

Recommended Cables

If you are using this motor and feedback device:	Use this cable:	See this wiring diagram:
Temposonics R-Series Linear sensors with MTS part numbers ending in 1S2G1102	Mating MTS molded extension cable for RG connector or integral P cable	Figure E.1 on page E-3
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure E.2 on page E-4
Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-CDNFDMP-SXX	Figure E.2 on page E-4
Allen-Bradley 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure E.3 on page E-4
Allen-Bradley MPL-A5xx and MPL-Bxxx motors motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure E.3 on page E-4
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-XXNFMP-SXX	Figure E.4 on page E-4
Allen-Bradley MPL-A3xx - MPL-A45xx and all MPG series motors with embedded Stegmann rotary encoder	Allen-Bradley 2090-UXNFDMP-SXX	Figure E.5 on page E-5
Any other motor with external Stegmann SHS-170 rotary encoder	Stegmann shielded twisted-pair cable with 12-pin DIN style connector	Figure E.6 on page E-5
Any other motor with external Stegmann SCS-60, SCS-70, SCM-60 or SCM-70, SRS-50, SRS-60, SRM-60, SRM-60, SRS-25 or SRM-25 rotary encoder	Stegmann shielded twisted-pair cable with 10-pin MS style connector	Figure E.7 on page E-5
Any other motor with external Stegmann SCS-Kit 101 or SCK-Kit 101 rotary encoder	Stegmann shielded twisted-pair cable with 8-pin Berg style connector	Figure E.8 on page E-6
Any other motor with external Stegmann SRS660 rotary encoder	Is available only with pre-attached Stegmann shielded twisted-pair cable of various lengths	Figure E.9 on page E-6

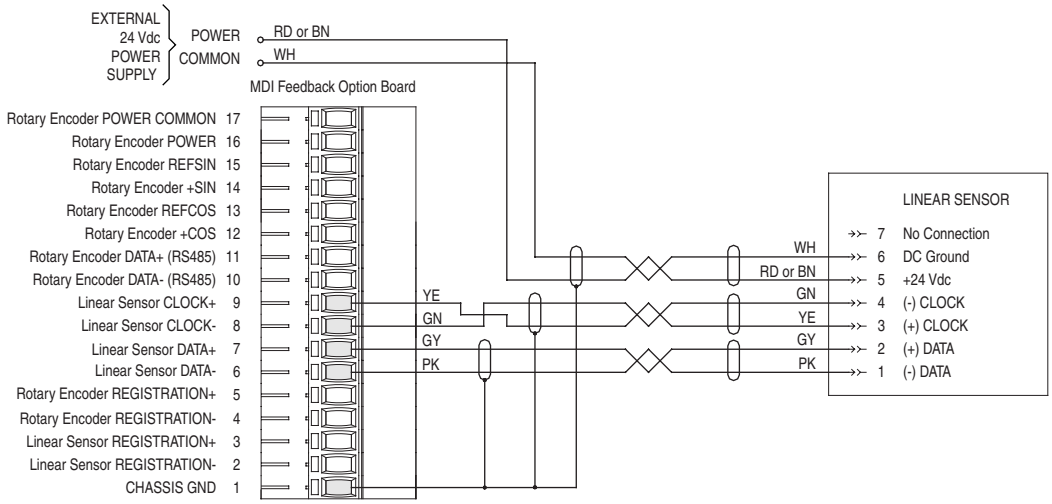
Wiring the MDI Option



Terminal	Signal	Description
17	Rotary Encoder POWER COMMON	Power supply for Rotary Encoder interface
16	Rotary Encoder POWER	
15	Rotary Encoder REFSIN	Positive Sine signal for Rotary Encoder interface
14	Rotary Encoder +SIN	Negative Sine signal for Rotary Encoder interface
13	Rotary Encoder REFCOS	Negative Cosine signal for Rotary Encoder interface
12	Rotary Encoder +COS	Positive Cosine signal for Rotary Encoder interface
11	Rotary Encoder DATA+ (RS485)	Positive DH485 terminal for Rotary Encoder interface
10	Rotary Encoder DATA- (RS485)	Negative DH485 terminal for Rotary Encoder interface
9	Linear Sensor CLOCK+	Positive Clock terminal for Linear Sensor interface
8	Linear Sensor CLOCK-	Negative Clock terminal for Linear Sensor interface
7	Linear Sensor DATA+	Positive SSI terminal for Linear Sensor interface
6	Linear Sensor DATA-	Negative SSI terminal for Linear Sensor interface
5	Rotary Encoder REGISTRATION+	Positive terminal for Rotary Encoder registration strobe
4	Rotary Encoder REGISTRATION-	Negative terminal for Rotary Encoder registration strobe
3	Linear Sensor REGISTRATION+	Positive terminal for Linear Sensor registration strobe
2	Linear Sensor REGISTRATION-	Negative terminal for Linear Sensor registration strobe
1	CHASSIS GND	Connection point for cable shields

Connection Examples

Figure E.1 Linear Sensor connections with MDI RG connector or P integral cable



Connection Examples

Figure E.2 Rotary Encoder connections for MPL-A5xx and MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-CDNFDMP-SXX cable

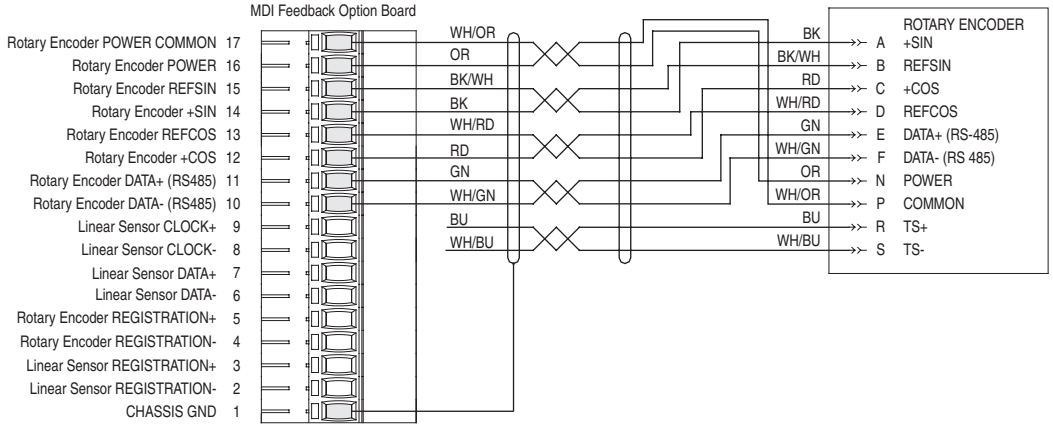
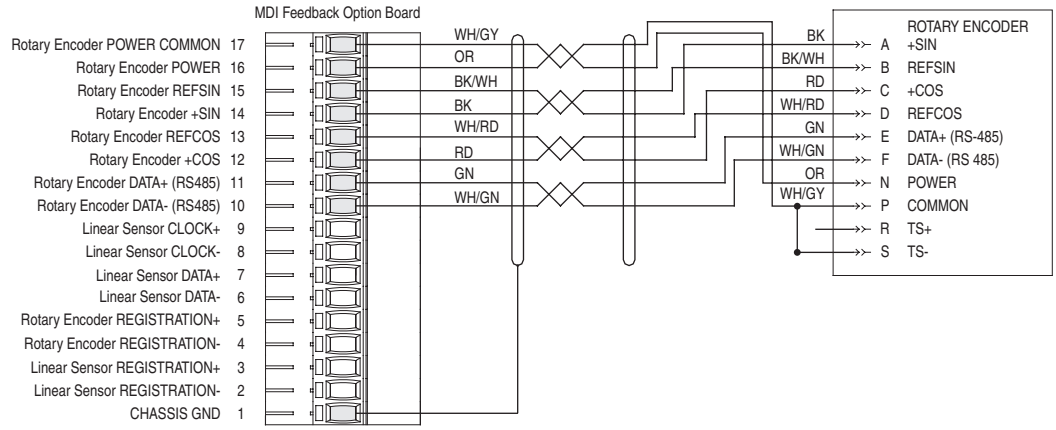
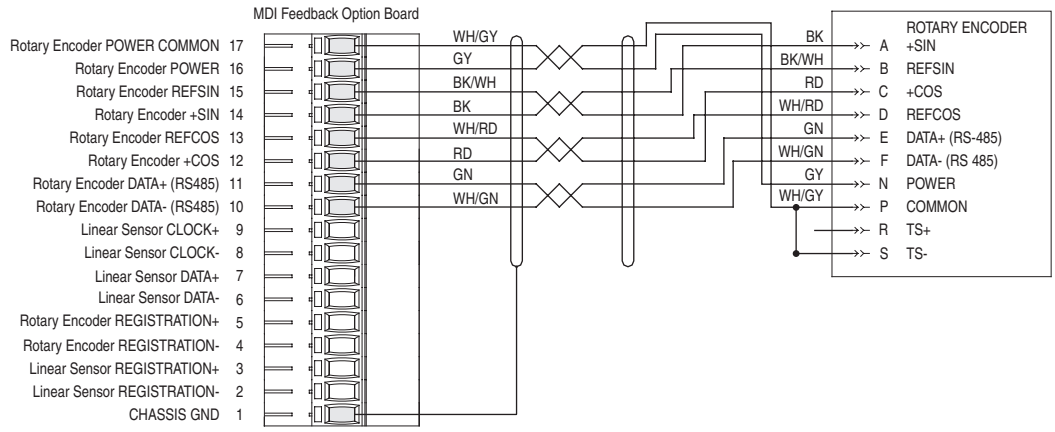


Figure E.3 Rotary Encoder connections for MPL-A5xx and MPL-Bxxx motors or 1326AB-BXXXX-M2L, -M2KXL, -S2L, and -S2KXL motors with 2090-XXNFMP-SXX cable



Note: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

Figure E.4 Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-XXNFMP-SXX cable



Note: Thermal Switch cannot be accessed using 2090-XXNFMP-SXX cable.

Connection Examples

Figure E.5 Rotary Encoder connections for MPL-A3xx - MPL-A45xx and all MPG series motors with 2090-UXNFDMP-SXX cable

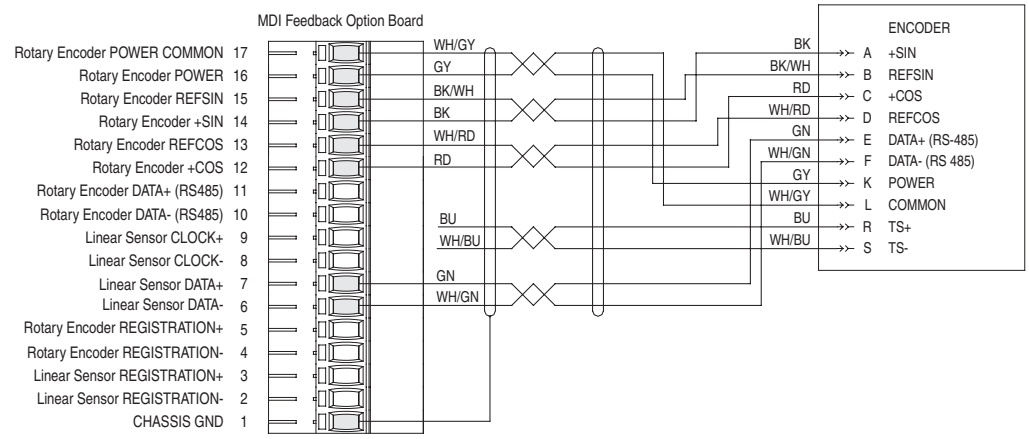


Figure E.6 Stegmann shielded twisted-pair cable with 12-pin DIN style connector

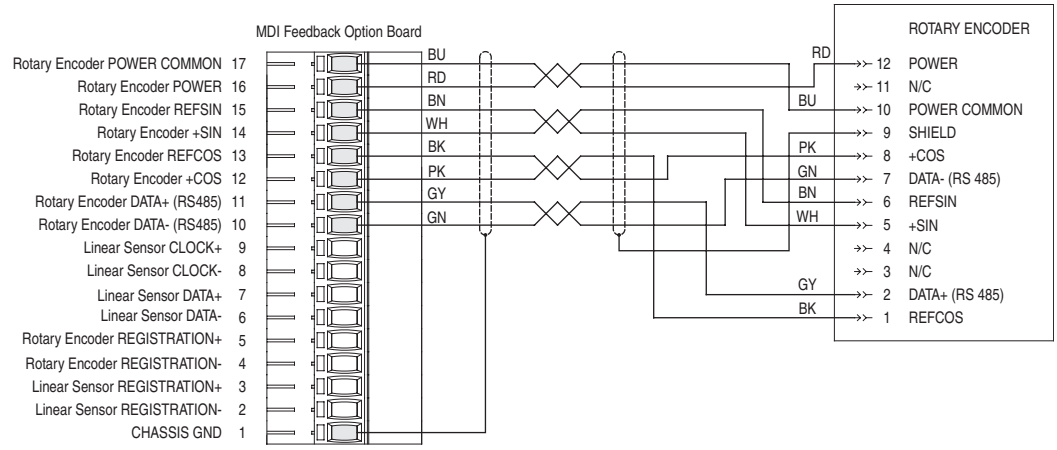
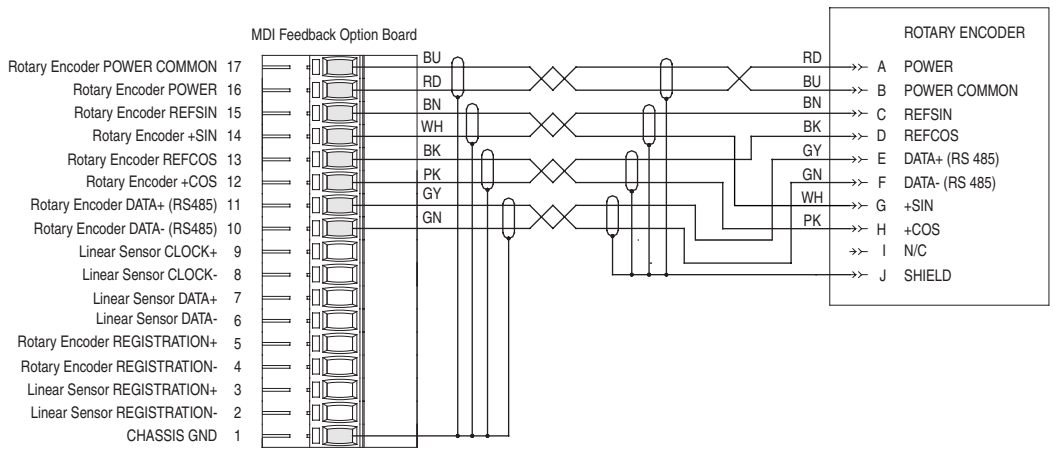


Figure E.7 Rotary Encoder connections with Stegmann shielded twisted-pair cable and 10-pin MS style connector



Connection Examples

Figure E.8 Rotary Encoder connections with Stegmann shielded twisted-pair cable and 8-pin Berg style connector

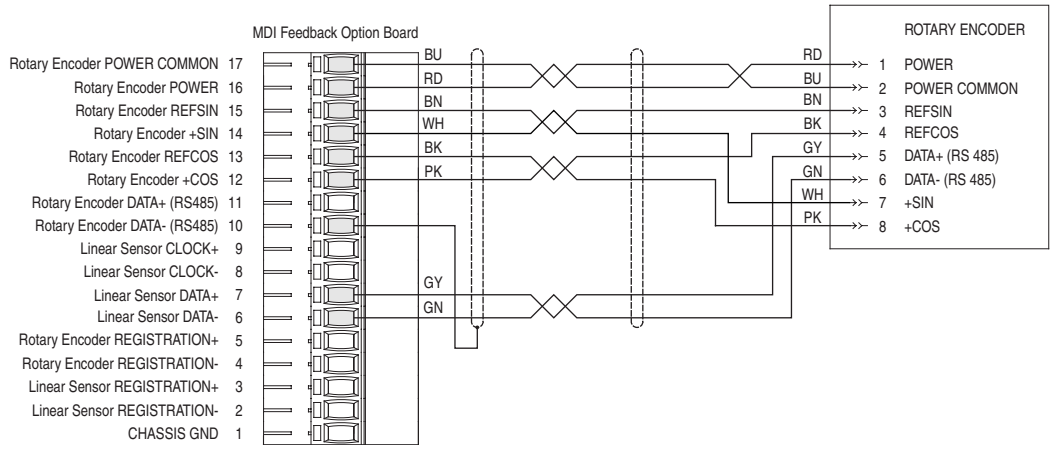


Figure E.9 Rotary Encoder connections with Stegmann pre-attached shielded twisted-pair cable

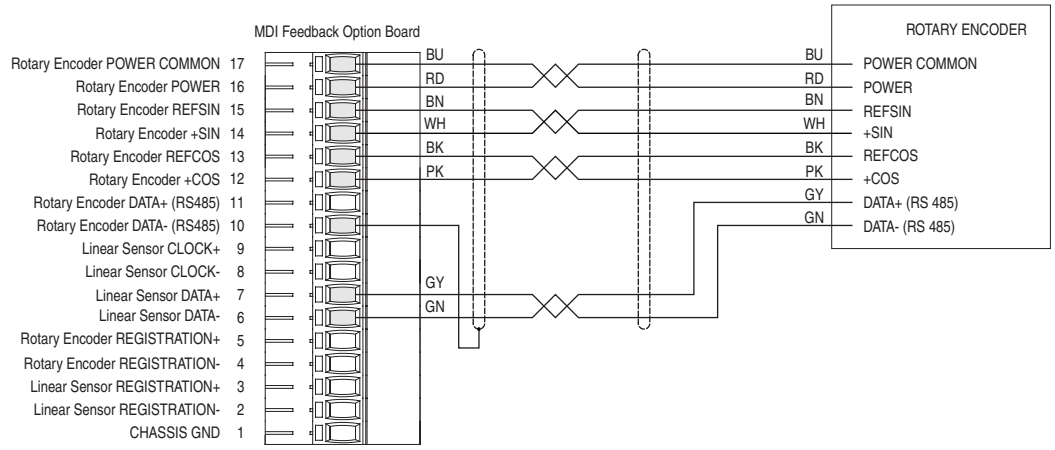
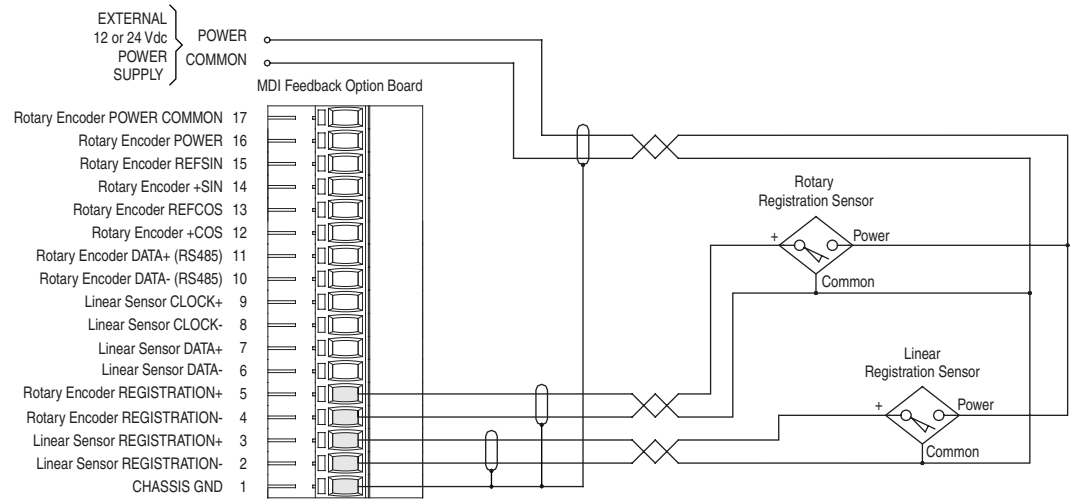


Figure E.10 Registration Sensor connection



Instructions for ATEX Approved PowerFlex 700H Drives in Group II Category (2) Applications with ATEX Approved Motors

General Information

This document provides information on operation of an ATEX[1] Approved drive and ATEX approved motor. The motor is located in a defined hazardous environment, while the drive is not. A protective system is required to stop current flow to the motor when an over temperature condition has been sensed in the motor. When sensed, the drive will go into a stop condition. To restart the drive, the over temperature condition must be resolved, followed by a valid start command to the drive. The PowerFlex 700H drive must have the 20C-DG1 option board installed in slot B of the control assembly for ATEX applications. Refer to 700H Control Circuit Board Designations on page 2-2 for more information.

The drive is manufactured under the guidelines of the ATEX directive 94/9/EC. These drives are in Group II Category (2) Applications with ATEX Approved Motors. Certification of the drive for the ATEX group and category on its nameplate requires installation, operation, and maintenance according to the requirements found in this document and the appropriate Motor Instruction Manual(s).

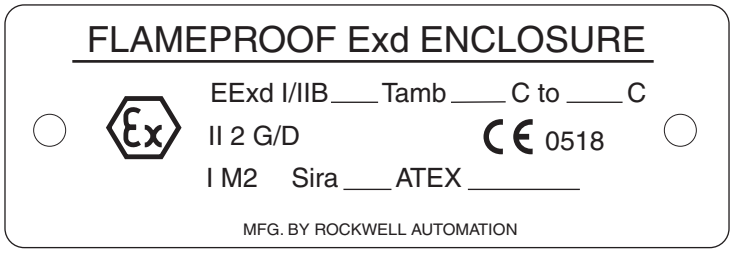
ATTENTION: Operation of this ATEX certified drive with an ATEX certified motor that is located in a hazardous environment requires additional installation, operation, and maintenance procedures beyond those stated in the standard user manual. Equipment damage and/or personal injury may result if all additional instructions in this document are not observed.

Motor Requirements

- The motor must be manufactured under the guidelines of the ATEX directive 94/9/EC. It must be installed, operated, and maintained per the motor manufacturer supplied instructions.
- Only motors with nameplates marked for use on an inverter power source, and labeled for specific hazardous areas, may be used in hazardous areas on inverter (variable frequency) power.
- When the motor is indicated for ATEX Group II Category 2 for use in gas environments (Category 2G) the motor must be of flameproof construction, EEx d (according to EN50018) or Ex d (according to EN60079-1 or IEC60079-1). Group II motors are marked with a temperature or a temperature code.

[1] ATEX is the French acronym for “Atmosphères Explosibles” which translates to Explosive Atmospheres in English.

- When the motor is indicated for ATEX Group II Category 2 for use in dust environments (Category 2D) the motor must be protected by an enclosure (according to EN50281-1-1 or according to IEC61241-1: Ex tD). Group II motors are marked with a temperature.
- The motor over temperature signal supplied to the drive must be a normally closed contact (open during over temperature condition) compatible with the digital (logic) input circuitry of the drive. If multiple sensors are required in the motor, the connection at the drive must be the resultant of all required contacts wired in series.
- Refer to all product markings for additional cautions that may apply.
- Typical motor markings are contained on a motor certification nameplate similar to the sample below.

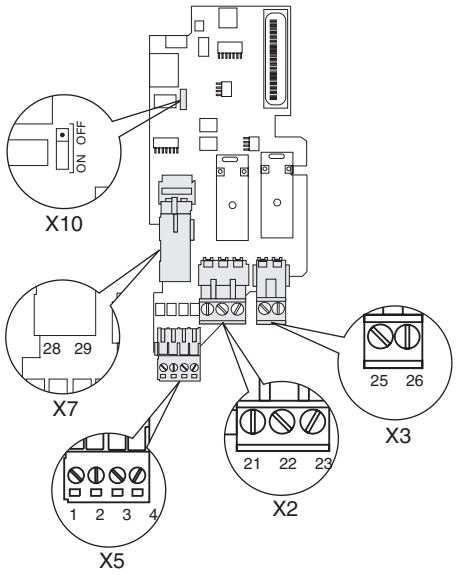


Drive Wiring

Important: ATEX certification of this drive requires that two separate inputs be configured to monitor a normally closed over temperature contact (or multiple contacts wired in series) presented to the drive from the motor.

The first input must energize the SD1 input (terminals X5-1 & X5-2) on the drive option board (20C-DG1). The second input must energize the SD2 input (terminals X5-3 & X5-4) on the option board. This option board must be installed in the drive for ATEX applications. It is offered with 24V DC input only. Both input signals are wired with respect to the drive's digital input common when using a control board with 24V I/O. Refer to Figure 2.2 on page 2-3 for wiring examples. Motor supplied contacts must have ratings compatible with the input circuit ratings and applied voltage level of the drive.

Table F.A Terminal Descriptions



Term. Blk.	No.	Signal	Description
X5	1	SD1+	Isolated Disable input 1 +24V +/-20% 10... 15mA
	2	SD1–	Virtual GND 1
	3	SD2+	Isolated Disable input 2 +24V +/-20% 10... 15mA
	4	SD2–	Virtual GND 2
X2	21	Digital Out 1 - N.C.	Max. Resistive Load: 240V ac / 30V dc - 1200VA, 150W Max. Current: 5A, Min. Load: 10mA Max. Inductive Load: 240V ac / 30V dc - 8400VA, 105W Max. Current: 3.5A, Min. Load: 10mA
	22	Digital Out 1 Common	
	23	Digital Out 1 - N.O.	
X3	25	Digital Out 2 Common	
	26	Digital Out 2 N.O.	
X7	28	TI1+	Thermistor input: $R_{trip} \geq 4.0\ k\Omega$ (PTC)
	29	TI1–	

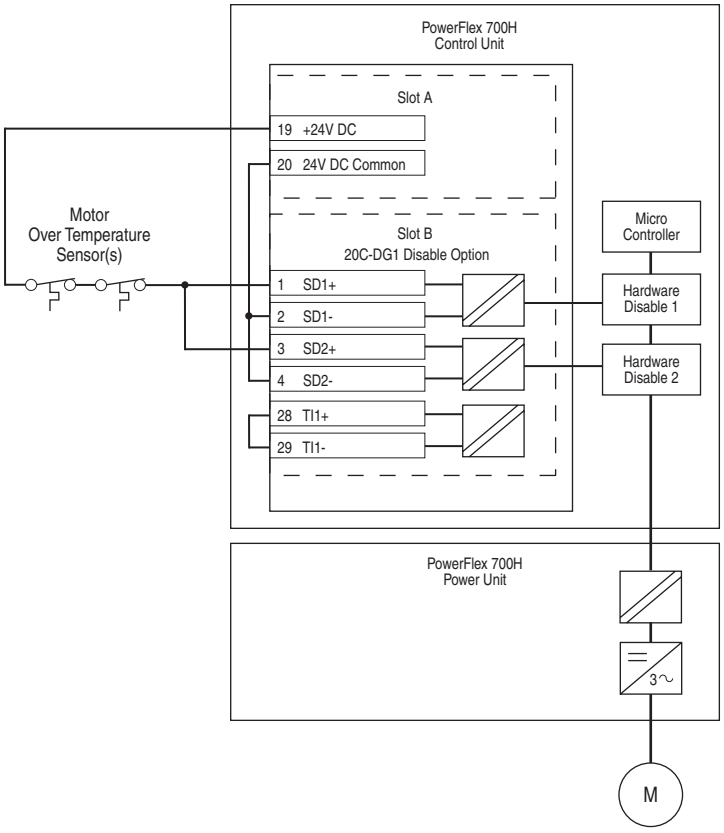
Important: The drive will not run unless one of the following conditions is met:

– A wire must be installed in the hardware thermistor input (X7-28 and X7-29) and the thermistor short circuit supervisor jumper X10 must be installed in the OFF position.

OR

– A thermistor must be installed in the hardware thermistor input (X7-28 and X7-29).

Figure 1 Wiring Example - Internal 24V Power Supply



Configuration

The PowerFlex 700H drive can be configure in one of five ways when using the 20C-DG1 option board, each resulting in the drive being put into a Gate Disabled state when digital inputs are removed or the thermistor is out of range.

1. Gate Disable Fault (59):

Configured by setting bit 10 “Gate Disable” of parameter 238 [Fault Config1].

If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. The drive HIM will display fault 59 “Gate Disable”.

When the condition is cleared, the fault can be reset and the drive can be restarted.

If only one digital input opens, the drive output will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

2. Gate Disable Alarm (59):

   Configured by setting bit 15 “Gate Disable” of parameter 259 [Alarm Config1].

   If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. The drive HIM will display alarm 59 “Gate Disable”.

   When the condition is cleared, the alarm will automatically clear in 10 seconds and the drive can be restarted.

   If only one digital input opens, the drive output will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

3. Neither of the “Gate Disable” bits, 10 in parameter 238 [Fault Config1] or 15 in parameter 259 [Alarm Config1], are set.

   If both digital inputs open, the drive output will be disabled and the motor will coast to a stop. No fault or alarm indication will be given, but the Gate Disable status can be seen in bit 0 “Gate Disable” of parameter 359 [20C-DG1 Status].

   When the condition is cleared, the drive can be restarted after 3 seconds.

   If only one digital input opens, the drive will be disabled and the motor will coast to a stop. Refer to Table F.B on page F-6 for a description of drive conditions and actions.

4. Both “Gate Disable” bits, 10 in [Fault Config1] and 15 in [Alarm Config1], are set:

   The Gate Disable fault takes precedence.

5. Thermistor Input:

   If the thermistor input goes out of range, the drive output will be disabled and the motor will coast to a stop. The drive will display fault 60 “Hrdwr Therm” on the drive HIM.

   When the condition is cleared, the fault can be reset and the drive can be restarted. This configuration requires that the two digital inputs remain closed to function.

Removing the 20C-DG1 Option Board

During maintenance or service there may be a need to remove the 20C-DG1 option board.

The drive is designed to generate a non-resettable fault F10 “System Fault” if the option board is removed. The operator must manually change parameter 358 [20C-DG1 Remove] to 1- “Remove” and then back to 0 - “Ready” to clear and acknowledge the fault.

Once maintenance or service is completed and the 20C-DG1 option card has been reinstalled, the drive will recognize the option card on power-up.

Verify Operation

At regular intervals during the life of the machine check the protective system for proper operation. Both channels shall be verified using the table below. How frequently the protective system is checked is dependent on the safety analysis of the machine section controlled by the drive.

Table F.B Gate Disable Status and Verification

Protective System Status	Drive In Gate Disable State	Drive In Gate Disable State	Drive In Gate Disable State	Drive Able To Run
Channel Operation				
SD1 - terminals X5-1 & X5-2 Par 359 [20C-DG1 Status], bit 3 “No Enable CH1”	Bit 3 = 1 No Power Applied	Bit 3 = 0 Power Applied	Bit 3 = 1 No Power Applied	Bit 3 = 0 Power Applied
SD2 - terminals X5-3 & X5-4 Par 359 [20C-DG1 Status], bit 4 “No Enable CH2”	Bit 4 = 1 No Power Applied	Bit 4 = 1 No Power Applied	Bit 4 = 0 Power Applied	Bit 4 = 0 Power Applied
Description For Verification				
PowerFlex 700H Drive Status	**Output Disabled**	**Output Disabled**	**Output Disabled**	**Output Enabled**
Par 359 [20C-DG1 Status], Bit 0 “Gate Disable” or Bits 2 “Unexp In Pro” and 15 “Unexp HW Pro”	Bit 0 = 1	Bit 2 = 1 Bit 15 = 1	Bit 2 = 1 Bit 15 = 1	Bit 0 = 0
Fault or Alarm	F59 “Gate Disable” (Fault or Alarm Based on drive set up)	F10 “System Fault”	F10 “System Fault”	None

Numerics

A

B

C

D

E

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W

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